US Army Corps
of Engineers®

CERCLA Record of Decision
Alabama Army Ammunition Plant – Area B
Soils, Surface Water, and Sediment

Final Record of Decision

Prepared for:
U.S. Army Corps of Engineers
Mobile District
Under Contract DACA21-02-D-0004
Delivery Order Number CK04

Prepared by:
Science Applications International Corporation
12100 Sunset Hills Road
Reston, Virginia 20190

August 2010

• Not in Env. Lower standard
, a property law - to record a covenant
Falls under
does not regulate waste or env
Shouldn't include the intent ... to take off the covenant without any re
is not standard

shared with me the letter our position is clear

10907264

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CERTIFICATION 4
CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Science Applications International Corporation (SAIC) has completed the Final Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Record of Decision for the Alabama Army Ammunition Plant – Area B, Childersburg, Alabama. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project as defined in the SAIC Quality Assurance Plan. During the independent technical review, compliance with established policy principles and procedures, using justified and valid assumptions, was verified. This included review of assumptions, methods, procedures, and materials used in analyses; the appropriateness of data used and the level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with the law and existing U.S. Army Corps of Engineers policy.

Rupa M. Price

Rupa M. Price
Task Manager

August 16, 2010
Date

Joseph E. Peters

Joseph E. Peters
QA Manager

August 16, 2010
Date

Connie D. Samson

Connie D. Samson
Independent Technical Review Team Leader
Project Manager

August 16, 2010
Date

Significant concerns and explanation of the resolutions are documented within the project file.

As noted above, all concerns resulting from independent technical review of the project have been considered.

Lisa D. Jones-Bateman
Vice President, SAIC

August 16, 2010
Date

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF EXHIBITS

LIST OF ACRONYMS

2,4-DNT	2,4-Dinitrotoluene
ACM	Asbestos-Containing Material
ADEM	Alabama Department of Environmental Management
ALAAP	Alabama Army Ammunition Plant
AR	Army Regulation
ARAR	Applicable or Relevant and Appropriate Requirement
BERA	Baseline Ecological Risk Assessment
BLS	Below Land Surface
BRAC	Base Realignment and Closure
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
COC	Chemical of Concern
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
CTE	Central Tendency Exposure
DA	Department of the Army
DNT	Dinitrotoluene
DOD	U.S. Department of Defense
EBS	Environmental Baseline Survey
ecoCOC	Ecological Chemical of Concern
ecoRGO	Ecological Remedial Goal Option
ELCR	Excess Lifetime Cancer Risk
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
FS	Feasibility Study
GOCO	Government-Owned/Contractor-Operated
GSA	General Services Administration
HASP	Health and Safety Plan
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HQ	Hazard Quotient
HTTD	High-Temperature Thermal Desorption
IRIS	Integrated Risk Information System
IROD	Interim Record of Decision
IRP	Installation Restoration Program
LRA	Local Redevelopment Authority
LUC	Land Use Control
MCL	Maximum Contaminant Level
msl	Mean Sea Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NPL	National Priorities List
NTU	Nephelometric Turbidity Unit
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
OU	Operable Unit

LIST OF ACRONYMS (Continued)

PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
ppm	Parts per Million
PRG	Preliminary Remediation Goal
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RfC	Reference Concentration
RfD	Reference Dose
RGO	Remedial Goal Option
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SERA	Screening-level Ecological Risk Assessment
S/S	Solidification/Stabilization
SVOC	Semivolatile Organic Compound
TETC	The Earth Technology Corporation
tetryl	2,4,6-Trinitrophenyl Methylnitramine
TNT	2,4,6 Trinitrotoluene
TPH	Total Petroleum Hydrocarbons
UECA	Uniform Environmental Covenant Act
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
UST	Underground Storage Tank
VCP	Vitreous Clay Pipe
VOC	Volatile Organic Compound
XRF	X-Ray Fluorescence

1. DECLARATION OF THE RECORD OF DECISION

1.1 SITE NAME AND LOCATION

The Alabama Army Ammunition Plant (ALAAP) is located in Talladega County, Alabama. The nearest town is Childersburg, Alabama, which is 4 miles south of ALAAP. The National Superfund database identification number is AL6210020008 (EPA 2005). Historically, ALAAP was an industrial complex with the primary function of producing explosives and propellants. The focus of this Record of Decision (ROD) is on Area B, which is 2,235 acres.

Five operable units (OUs) have been established by the Army and U.S. Environmental Protection Agency (EPA) to manage the restoration activities at ALAAP – Area B. The OUs are specified in Exhibit 1-1.

Exhibit 1-1. ALAAP – Area B Operable Units
Alabama Army Ammunition Plant, Childersburg, Alabama

Operable Units	Army Designation	EPA Designation
Study Areas 6, 7, 10, and 21	OU 3	OU 2
Study Areas 2, 10, 16, 17, 19, and 22	OU 4	OU 6
Stockpiled Soils	OU 2	OU 1
Area B Soil, Surface Water, and Sediment	OU 1	OU 7
Area B Groundwater	OU 1	OU 4

Study Area 10 was subdivided into Study Areas 10E and 10W during the course of the Remedial Investigation (RI). Further details on Study Area 10's division are provided in Section 2.5.11 of this ROD. The Stockpiled Soils OU was addressed in a December 1991 ROD (U.S. Army 1991). Therefore, the Stockpiled Soils will not be addressed further in this ROD. This ROD addresses the nongroundwater (i.e., soil, sediment, and surface water) portion of ALAAP – Area B. The groundwater portion of Area B (i.e., EPA designated OU 4) will be addressed in a separate ROD.

1.2 STATEMENT OF BASIS AND PURPOSE

This ROD presents the Selected Remedy for ALAAP – Area B, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on technical data and analyses that can be found in the Administrative Record file for this site. EPA and the Alabama Department of Environmental Management (ADEM) concur with the Selected Remedy.

1.3 ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 DESCRIPTION OF THE SELECTED REMEDY

This ALAAP – Area B ROD addresses the chemicals of concern (COCs) at 27 study areas within ALAAP – Area B. No further action (NFA) was deemed necessary at 13 of the 27 study areas. Two remedies were selected to address Study Areas 2, 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 22, 26, Building 6 –

Coke Oven, and the South Georgia Road Dump. For Study Area 2 (Smokeless Powder Facility), the Selected Remedy includes excavation and offsite disposal with land use controls (LUCs). The remaining study areas will be managed with LUCs.

Based on data collected after completion of all investigations and interim response actions at some sites (as documented in the Interim Records of Decision [IRODs]), all remaining study areas within Area B (Study Areas 5, 6, 9, 10E, 20, 25, 27, Downed Utility Poles with Transformers, Transformer Storage Area, Fertilizer and Pesticide Storage, Gas Station, Underground Storage Tanks [USTs], and Stockpiled Soils) were determined to be qualified for NFA.

The Selected Remedy for Study Area 2 involves the following:

- Excavation of soil containing polynuclear aromatic hydrocarbons (PAHs) above the industrial/commercial remedial goal options (RGOs)
- Offsite disposal of the impacted soil in a secure landfill, such as a Resource Conservation and Recovery Act (RCRA) Subtitle D landfill (assuming the soil is nonhazardous)
- Collection of confirmation samples to confirm that contamination has been removed
- Restoration of the study area using clean backfill
- Institution of LUCs to prohibit the residential use of the property, since COCs would remain in soil at concentrations exceeding the residential RGOs.

Study Areas 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 22, 26, Building 6 – Coke Oven, and the South Georgia Road Dump will be subject to limited actions involving LUCs, including administrative restrictions and inspections. The LUCs will focus on restricting land use from potential future residential purposes, including residential housing, schools, and child care facilities, within each study area. The LUCs will become an integral part of the city of Childersburg Local Redevelopment Authority (LRA) master plan.

1.5 STATUTORY DETERMINATIONS

The Selected Remedies are protective of human health and the environment, comply with Federal and state requirements that are applicable or relevant and appropriate to the remedial action, are cost effective, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

The Selected Remedies for Study Areas 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 22, 26, Building 6 – Coke Oven, and the South Georgia Road Dump do not satisfy the statutory preference for treatment as a principal element of the remedy. However EPA and the State of Alabama believe that the Selected Remedies are consistent with the planned reuse, would be protective of human health and the environment for the intended future land uses (industrial/recreational/commercial according to the Redevelopment Plan), would comply with applicable or relevant and appropriate requirements (ARARs), and would be cost effective. The Army recognizes the statutory preference against offsite land treatment of wastes, as the Selected Remedy for Study Area 2 involves. However, the volume of soil requiring offsite disposal and treatment is low and can be implemented at a significantly lower cost than onsite treatment alternatives. Exhibit 1-2 presents the preferred alternatives for each study area.
← selected remedies?

Because the remedies that will be applied to Study Areas 2, 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 22, 26, Building 6 – Coke Oven, and the South Georgia Road Dump will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

-No. Selected Remedies

Exhibit 1-2. ALAAP – Area B Preferred Alternatives
Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area		Preferred Alternative
2	Smokeless Powder Facility	Excavation and offsite disposal with LUCs
3	Sanitary Landfill and Lead Facility	Conduct limited actions: • Implement LUCs to prevent future residential use of the study areas • Post signs warning against consumption of fish tissue from Study Areas 21 and 26 • Monitor the effectiveness of the LUCs through annual inspections
4	Manhattan Project Area	
7	Northern TNT Manufacturing Area	
8	Acid/Organic Manufacturing Area	
10W	Tetryl Manufacturing Area	
16	Flashing Ground	
17	Propellant Shipping Area	
18	Blending Tower Area	
19	Lead Facility	
21	Red Water Ditch	
26	Crossover Ditch	
CERFA Study Area	Building 6 – Coke Oven	
Other	South Georgia Road Dump	
22	Demolition Landfill	• Implement LUCs to prevent excavation, digging, drilling, or other activities that may damage the landfill cap within Study Area 22 • Monitor effectiveness of the LUCs and monitor for any damage to the landfill cap through annual inspections
5	Red Water Storage Basin	NFA – risks below targets
CERFA Study Area	Gas Station	
6	Southern TNT Manufacturing Area	NFA – study area remediated
31, 32, TC4A, TC4B	Stockpiled Soils	
CERFA Study Area	Transformer Storage Building	
	Downed Utility Poles with Transformers	
9	Aniline Sludge Basin	NFA – rationale presented in weight-of-evidence evaluation conducted in FS
10E	Tetryl Manufacturing Area	
20	Rifle Powder Finishing Area	
25	Storage Battery/Demolition Debris	
27	Beaver Pond Drainage System	
CERFA Study Area	Underground Storage Tanks	
	Fertilizer and Pesticide Storage	

1.6 ROD DATA CERTIFICATION CHECKLIST

A data certification checklist is provided in Exhibit 1-3. This checklist certifies that the ROD contains information pertaining to remedy selection. References to page numbers where the information can be found in the body of this document also are indicated.

Exhibit 1-3. Data Certification Checklist
Alabama Army Ammunition Plant, Childersburg, Alabama

Information	Information in ROD	ROD Section and Page Number
COCs	✓	2-32, 2-33, 2-44, 2-45, 2-47, 2-48
Baseline Risk	✓	2-19, 2-30, 2-31
Cleanup Levels	✓	2-65
Source Materials	✓	2-2
ARARs	✓	2-50, 2-62, 2-63
Current and Future Land Use	✓	2-19
Land Use with Remedy Implementation	✓	2-62, 2-65
Costs Associated with Remedy	✓	2,56, 2-59, 2-61, 2-62, 2-65
Key Factors for Remedy Selection	✓	2-66

1.7 AUTHORIZING SIGNATURES AND SUPPORT AGENCY ACCEPTANCE OF REMEDY

William O'Donnell
Headquarters, Department of the Army
Chief Operational Army and Medical Branch, BRAC Division
Office of the Assistant Chief of Staff for Installation Management
2530 Crystal Drive
Arlington, Virginia 22202

______________________________ ______________________
Army Date

Franklin E. Hill, Director
Superfund Division
United States Environmental Protection Agency, Region 4

______________________________ ______________________
EPA Date

Concurrence:
William Gerald Hardy, Chief
Land Division
Alabama Department of Environmental Management

______________________________ ______________________
ADEM Date

2. SECTION BY SECTION DESCRIPTION OF THE DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

ALAAP is in Talladega County, Alabama. The nearest town is Childersburg, Alabama, which is 4 miles south of ALAAP. Area B is in the northwestern section of the former ALAAP property. The National Superfund database identification number is AL6210020008 (EPA 2005). The U.S. Army is the lead agency for site activities and the source of cleanup funding, while EPA Region 4 and ADEM are the support agencies.

Historically, ALAAP was an industrial complex with the primary function of producing explosives and propellants. Exhibit 2-1 shows the site location. The focus of this ROD is on Area B, which is 2,235 acres.

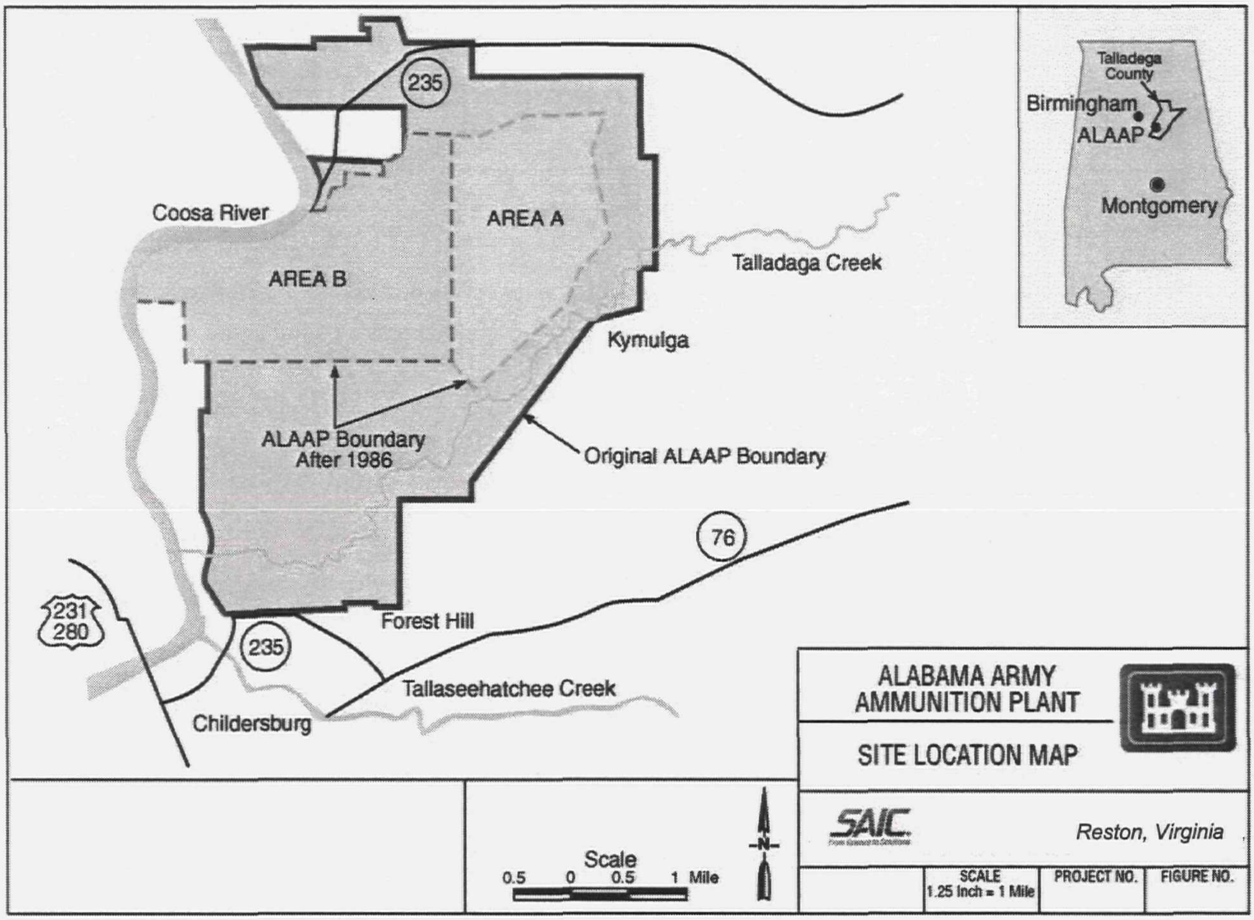


Exhibit 2-1. Site Location Map
Alabama Army Ammunition Plant, Childersburg, Alabama

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The following sections present information on the history of ALAAP and investigation and enforcement activities.

2.2.1 Site History

ALAAP was established in 1941 on 13,233 acres of land near the junction of Talladega Creek and the Coosa River. The original mission of ALAAP was to manufacture 2,4,6-trinitrotoluene (TNT), dinitrotoluene (DNT), 2,4,6-trinitrophenyl methylnitramine (tetryl), and single-base smokeless powder for cannon and small-arms ammunition in support of World War II efforts. The plant also produced the necessary supporting chemicals for the manufacturing operations, including nitric and sulfuric acids. Much of the original site was cleared when the facility was constructed in 1941. However, 3,411 acres of controlled pine forest have been planted since the cessation of operations in 1973. Logging operations have been allowed since that time.

ALAAP was operated by the EI duPont Company as a Government-owned/contractor-operated (GOCO) facility during World War II with the intent of producing nitrocellulose, single-base smokeless powder, and nitroaromatic explosives (i.e., TNT, DNT, and tetryl). The plant was designed to manufacture 400,000 pounds of TNT; 30,000 pounds of DNT; and 36,000 pounds of tetryl on a daily basis. The plant's peak monthly production of the nitroaromatic explosives was 15.6 million pounds of nitrocellulose in October 1942, 21.8 million pounds of TNT in April 1945, and 2.4 million pounds of tetryl in March 1945 (DA 1978).

In addition to the manufacture of propellants and explosives, the plant produced sulfuric and nitric acids, aniline, diphenylamine, oleum (40 percent sulfur trioxide and sulfuric acid), sellite (sodium sulfite), and N,N-dimethylaniline. Spent acids were recycled and unrecoverable wastes resulting from these operations were disposed of onsite by discharge to an unlined ditch (DA 1978). In August 1945, the plant reverted to a standby status and the Government began excessing property. The acid facility was leased to Tennessee Copper Corporation between 1947 and 1966 for the manufacture of acids and organic compounds on the site. Average daily production of oleum and sellite at ALAAP during its operation was 400 and 15 tons, respectively.

Between 1949 and 1971, the Beaunit Corporation, an affiliate of El Paso Natural Gas, manufactured rayon in a leased area north of Area B. In January 1954, the Government entered into a contract with the Liberty Powder Defense Corporation, a subsidiary of Olin Mathieson Chemical Corporation, in an effort to rehabilitate the plant. The contract provided for maintenance and consultant services in connection with the plant rehabilitation. Rehabilitation was initiated in April 1955, but was halted in October 1957 with only 75 percent of the rehabilitation complete. The plant was maintained in various stages of standby status until the early 1970s.

In 1973, the Army released ALAAP to the General Services Administration (GSA) so that it could be sold. However, GSA declined to accept 1,620 acres of the former manufacturing area, part of what is now designated as Area B, because the area could not be certified free from contamination. Beginning in 1973, a controlled burning program was implemented by the Army to destroy explosives residues in the former industrial and storage areas. Nearly all of the buildings that were components of the explosives manufacturing facilities and the acid and organic chemical manufacturing facilities were burned. Sewers and underground utilities were left intact (ESE 1981).

In 1977, a 1,354-acre parcel in the GSA Area containing the former nitrocellulose manufacturing area, the smokeless powder manufacturing area, and 247 associated buildings was sold to Kimberly-Clark Corporation. In the same year, the Army leased back 291 acres within the GSA Area from Kimberly-Clark so that the area could be decontaminated, the manufacturing equipment removed, and the buildings razed. These areas comprise the Leaseback Area. One hundred and fifty-five additional buildings used primarily for explosives storage were left intact (ESE 1981).

In 1981, ALAAP was divided into Area A (2,714 acres) to the east, containing the former storage area and GSA Area still under U.S. Government control, and Area B (2,235 acres), consisting of the former manufacturing (industrial) area. ALAAP was proposed for inclusion on the National Priorities List (NPL) by EPA in 1984 and was included on the list in 1987. In 1988, the Secretary of Defense recommended that ALAAP be closed and placed it on the U.S. Department of Defense (DOD) Base Realignment and Closure (BRAC) 1988 list. Area A was auctioned in May 1990 and conveyed in August 1990 to private buyers for unrestricted use, but they currently use the properties for logging and as hunting grounds. Because all necessary remedial actions had not been concluded, the Army submitted a request for deferral of the CERCLA 120(h)(3) covenant. The deferral was granted by EPA with ADEM concurrence. Area B was transferred by Quitclaim deed to the city of Childersburg LRA on March 17, 2003. The use restrictions are presented in Section III of "Exhibit C" of the Quitclaim deed.

Currently, Area B is being redeveloped as an industrial park by the city of Childersburg LRA. The Quitclaim deed for Area B includes a restrictive covenant that requires the future use of the property to be industrial with ancillary commercial, recreational, and natural habitat uses.

2.2.2 Investigation and Enforcement Activities

In 1978, the U.S. Army Environmental Center (USAEC) (formerly the U.S. Army Toxic and Hazardous Materials Agency [USATHAMA]), managing the Army's Installation Restoration Program (IRP), conducted a records search, which concluded that specific areas of the facility were potentially contaminated by explosives and lead compounds. Further studies at ALAAP confirmed soils contamination with explosives compounds, asbestos, and lead. Several investigations were conducted between 1981 and 1983 to define contamination further. In 1984, ALAAP was proposed for inclusion on the CERCLA NPL.

An RI//Feasibility Study (FS) under the DOD IRP was initiated in 1985 to determine the nature and extent of contamination at ALAAP and the alternatives available to remediate the site. For the purposes of the RI/FS, the facility was divided into two general areas. Area A consisted of the eastern portion of the facility and Area B consisted of the western portion. The initial RI under the IRP confirmed the existence of explosives, asbestos, and lead contamination in the soil in Area A and in the soil, sediment, and groundwater of Area B. The RI for Areas A and B was completed in 1986. As a result of the findings of the RI, cleanup activities at Area A were conducted in 1986 and 1987, and included building decontamination and demolition, soil excavation, and stockpiling. Initially, 21,400 cubic yards of contaminated soils were excavated from Area A and stockpiled in Area B in two covered buildings and on a concrete slab that subsequently was covered with a membrane liner. In July 1987, ALAAP was placed on the NPL.

In February 1991, a Characterization Study was conducted for the Stockpiled Soils excavated from Area A and stored in Area B. The study confirmed that explosives, lead, and asbestos contamination was present above acceptable limits. In March 1991, a tornado demolished one of the two buildings that contained Stockpiled Soils. Soils from the demolished building were relocated on the concrete slab and covered with a membrane liner. An FS was completed for the Stockpiled Soils in October 1991. A ROD for the Stockpiled Soils Area OU was issued in December 1991 and recommended incineration as the preferred alternative. The incineration of Stockpiled Soils commenced in May 1994. A supplemental RI/FS for Area B was submitted in March 1992.

A ROD was issued in December 1991 for Study Areas 31, 32, TC4A, and TC4B (the Stockpiled Soils) (U.S. Army 1991). The Selected Remedy for the study areas discussed in the ROD included thermal treatment of soils contaminated with metals, explosives, and asbestos and onsite disposal of the soils. The remedial actions outlined in the ROD were initiated on April 9, 1994 and completed on August 22, 1994. In addition, the buildings associated with the Stockpiled Soils were dismantled and the slab was decontaminated.

An IROD was issued for Study Areas 6, 7, 10, and 21 on November 14, 1994 (Weston 1994). The Selected Remedy for the study areas discussed in the IROD included the incineration/stabilization of metals- and explosives-contaminated soils and sediments associated with the former manufacturing and waste disposal areas and deactivation and grouting of concrete-encased vitreous clay pipe (VCP) and excavation, incineration, and onsite disposal of VCP associated with the former Industrial Sewer System. The remedial actions outlined in the IROD were initiated in January 1995 and completed in June 1996. The incinerator was removed and the site restored by April 24, 1998.

An IROD was issued for Study Areas 2, 10, 16, 17, 19, and 22 in October 1996 (Weston 1996e). The Selected Remedy for the study areas discussed in the IROD included the incineration/stabilization of metals- and explosives-contaminated soils for Study Areas 2, 10, 16, 17, and 19 and design and construction of an engineered cap at Study Area 22. The remedial actions outlined in the IROD for Study Areas 2, 10, 16, 17, and 19 were initiated in November 1996 and completed on January 18, 1997. The remedial actions outlined in the IROD for Study Area 22 were initiated in October 1998; the final topographic survey after placing the protective fill over the geomembrane was completed on February 23, 1999.

Upon completion of the IRODs, subsequent sampling indicated that further actions were necessary for some of the sites included in the IRODs (i.e., Study Areas 2, 16, 17, and 19). These study areas are included in the Selected Remedies outlined in this ROD.

The following documents describe the relevant studies conducted at ALAAP – Area B. More detailed information is available in documents for public review at the Earl A. Rainwater Memorial Library, Childersburg, Alabama. These documents include:

- Installation Assessment of Alabama Army Ammunition Plant, Report 130, May 1978
- Supplemental RI/FS for Soils in Area B, ALAAP Draft Endangerment Assessment, December 1990
- Stockpile Characterization Report for Alabama Army Ammunition Plant, Childersburg, Alabama, July 1991
- Remedial Investigation and Feasibility Study of the Industrial Sewer System, Alabama Army Ammunition Plant, Childersburg, Alabama, September 1991
- Feasibility Study for the Alabama Army Ammunition Plant, Soil Stockpile Area, October 1991
- Proposed Plan for Early Remedial Action of Stockpiled Soils at Alabama Army Ammunition Plant Stockpiled Soils Area Operable Unit, November 1991
- Record of Decision for Early Remedial Action of Stockpiled Soils at Alabama Army Ammunition Plant Stockpiled Soils Area Operable Unit, December 1991
- Supplemental Remedial Investigation/Feasibility Study (RI/FS) for Area B, Alabama Army Ammunition Plant, Draft Feasibility Study, March 1992
- Supplemental RI/FS for Soils in Area B, ALAAP Final Baseline Risk Assessment, Volume I, October 1991, Volume II, April 1992
- Supplemental Remedial Investigation/Feasibility Study (RI/FS) for Soils in Area B, Final Baseline Risk Assessment, August 1992
- Supplemental Remedial Investigation/Feasibility Study (RI/FS) for Soils in Area B, Final Remedial Investigation, June 1993

- Supplemental Remedial Investigation Report for Alabama Army Ammunition Plant – Area B Final Report, August 2001
- Feasibility Study for Alabama Army Ammunition Plant – Area B, Revised Final Feasibility Study, September 2008.

2.3 COMMUNITY PARTICIPATION

The Proposed Plan for ALAAP – Area B was made available to the public in September 2008. This plan and related documents are located at the Earl A. Rainwater Memorial Library, Childersburg, Alabama.

The notice of availability of these documents was published on September 17 and 21, 2008 in the local Childersburg newspaper, and a public comment period was held from September 17 to October 16, 2008. A public meeting was held at the Childersburg City Hall on September 23, 2008. EPA and ADEM were present at the public meeting to answer questions. No public comments were received during the public comment period.

2.4 SCOPE AND ROLE OF OU

As with many Superfund sites, the problems at the ALAAP – Area B site are complex. As a result, EPA has organized the work into five operable units, as presented in Exhibits 2-2 and 2-3.

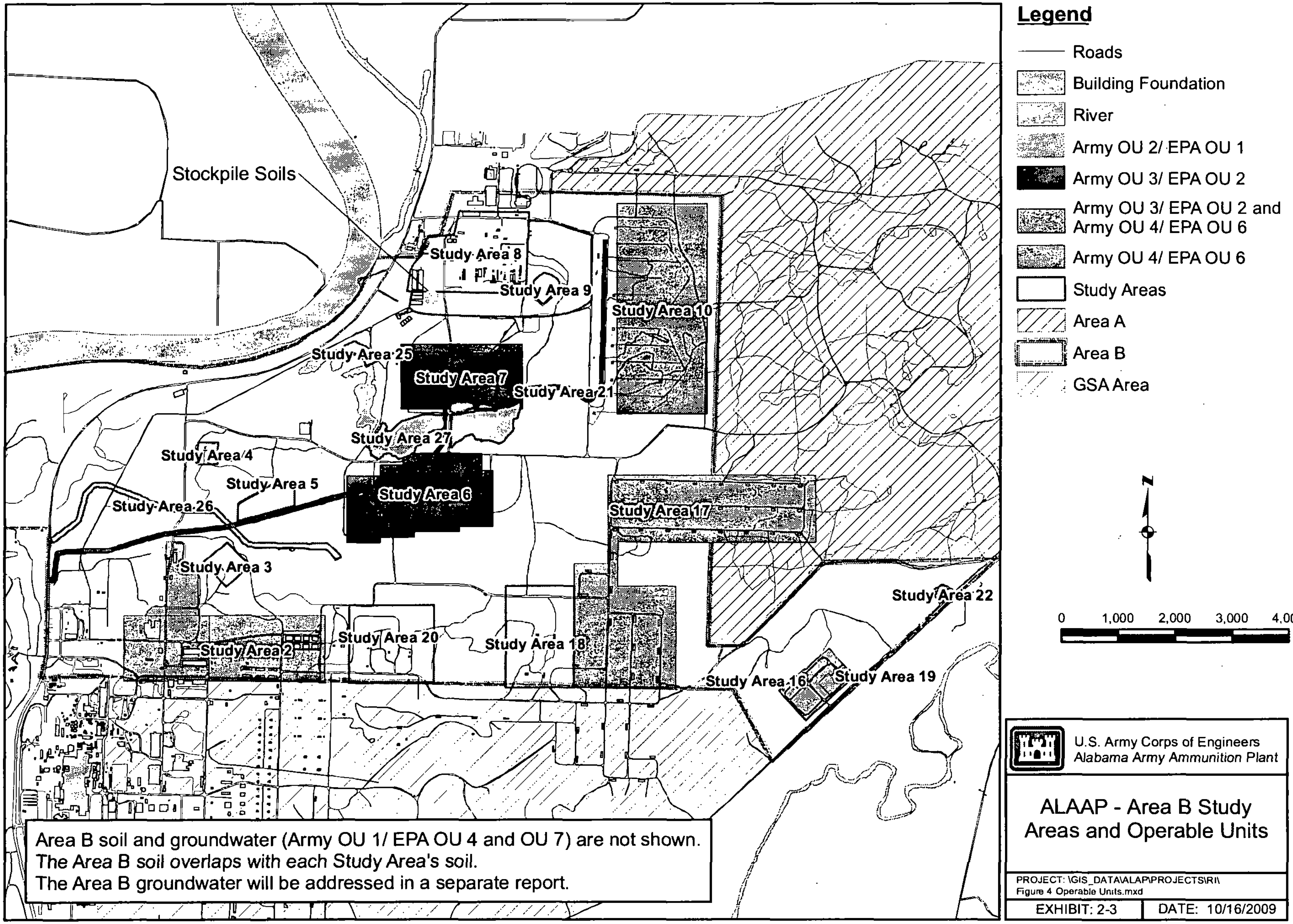
Exhibit 2-2. ALAAP – Area B Operable Units
Alabama Army Ammunition Plant, Childersburg, Alabama

Operable Units	Army Designation	EPA Designation
Study Areas 6, 7, 10, and 21	OU 3	OU 2
Study Areas 2, 10, 16, 17, 19, and 22	OU 4	OU 6
Stockpiled Soils	OU 2	OU 1
Area B Soil, Surface Water, and Sediment	OU 1	OU 7
Area B Groundwater	OU 1	OU 4

Study Area 10 was subdivided into Study Areas 10E and 10W during the course of the RI. Further details of Study Area 10's division are provided in Section 2.5.11 of this ROD. The Stockpiled Soils OU (EPA designated OU 1) was addressed in a December 1991 ROD, which recommended incineration as the preferred alternative. The incineration of Stockpiled Soils commenced in May 1994. Two IRODs were submitted for EPA designated OU 2 and OU 6 in November 1994 and October 1996, respectively. Both OU 2 and OU 6 address metals- and explosives-contaminated soils using a combination of incineration and stabilization methods. This ROD is a summary of all of the IRODs and addresses the soils portion of ALAAP – Area B (EPA designated OU 7). The groundwater portion of Area B (i.e., EPA designated OU 4) will be addressed in a separate ROD.

2.5 SITE CHARACTERISTICS

This section provides a general overview of the ALAAP – Area B site, describes the conceptual site model (CSM) on which the risk assessment and response action are based, discusses the general sampling strategy at the site, and describes each study area.


Legend
Roads
Building Foundation
River
Army OU 2/ EPA OU 1
Army OU 3/ EPA OU 2
Army OU 3/ EPA OU 2 and Army OU 4/ EPA OU 6
Army OU 4/ EPA OU 6
Study Areas
Area A
Area B
GSA Area
N
0 1,000 2,000 3,000 4,000 Feet
Stockpile Soils
Study Area 8
Study Area 9
Study Area 10
Study Area 25
Study Area 7
Study Area 21
Study Area 27
Study Area 4
Study Area 5
Study Area 6
Study Area 26
Study Area 17
Study Area 3
Study Area 22
Study Area 20
Study Area 18
Study Area 2
Study Area 16
Study Area 19
Area B soil and groundwater (Army OU 1/ EPA OU 4 and OU 7) are not shown.
The Area B soil overlaps with each Study Area's soil.
The Area B groundwater will be addressed in a separate report.
U.S. Army Corps of Engineers
Alabama Army Ammunition Plant
ALAAP - Area B Study Areas and Operable Units
PROJECT: \GIS_DATA\ALAP\PROJECTS\RI\
Figure 4 Operable Units.mxd
EXHIBIT: 2-3
DATE: 10/16/2009

2.5.1 General Overview

ALAAP was originally 13,233 acres and is in the Coosa Valley and the Valley and Ridge physiographic province. This ROD focuses on Area B of ALAAP, which is 2,235 acres. The border between the Valley and Ridge province and the Piedmont province is south of ALAAP between Talladega and Tallaseehatchee creeks. The terrain is level to rolling and largely suited to pasture and timberland, with elevations ranging from 117 to 183 meters above mean sea level (msl). The bedrock underlying ALAAP has been mapped on a regional scale and identified as undifferentiated Knox Group of Upper Cambrian to Lower Ordovician age dolomite.

The majority of the surface runoff from ALAAP drains either west or southwest into the Coosa River. A small portion of the southern and eastern side of ALAAP drains toward Talladega Creek, a tributary of the Coosa River. Prior to the construction of ALAAP, the area consisted of farms, woodlands, and wetlands. Much of the western half of ALAAP was poorly drained. Small natural drainways were enlarged and rerouted to provide drainage from the various manufacturing operations. No natural ponds existed on ALAAP during its operation. Two large storage lagoons were constructed in Area B to retain industrial wastes. Extensive wooded swamp and open pond areas have developed in the drainage systems at ALAAP since the beginning of demolition activities in 1973, primarily as a result of damming of drainways by beavers.

2.5.2 Sampling Strategy

Field sampling conducted at ALAAP was based on the size and locations of the individual study areas, potential media that may have been impacted by site activities, and strategic placement of monitoring locations around and between study areas. The majority of the ALAAP – Area B study areas were investigated as source areas with a sampling strategy that focused on identifying the vertical and horizontal extent of chemical contamination in soil and sediment in and around the study areas. Existing data and sampling locations were used extensively in developing the overall strategy. Phase 2 and 3 field investigation activities were developed to fill data gaps and narrow the focus of the investigation to specific study areas and data needs identified following the Phase 1 RI activities.

2.5.3 Study Area 2 – Smokeless Powder Facility

The majority of the Smokeless Powder Facility was on 74 acres in the Leaseback Area south of ALAAP – Area B. The buildings associated with the Smokeless Powder Facility were decontaminated and burned, the equipment was decontaminated and salvaged, the area was transferred to Kimberly-Clark, and the area is now owned by Bowater, Inc. (QORE 2002). However, a portion of Study Area 2 remained under Army control. On this portion, an interim removal action was conducted to excavate, incinerate, and landfill soil contaminated with 2,4-dinitrotoluene (2,4-DNT). The interim removal action was completed in 1996 and approximately 185 cubic yards of soil (50 by 50 feet wide and 2 feet deep) were excavated and transported to the Transportable Incineration System for thermal treatment (Weston 1996a). Confirmatory samples were collected to demonstrate that the contamination had been removed. A Supplemental RI and baseline risk assessment were conducted shortly thereafter, which indicated potential concerns for industrial and construction land use, unrestricted land use (i.e., residential), and ecological receptors. An FS was conducted to evaluate the elevated concentrations of metals, PAHs, and 2,4-DNT in the soils at Study Area 2. The weight-of-evidence screening conducted as part of the FS concluded that metals were not a concern for the ecological receptors. However, there are remaining concerns to human health for both likely and unrestricted uses. Further protective measures are required to address the industrial/construction and residential COCs at Study Area 2.

2.5.4 Study Area 3 – Sanitary Landfill and Lead Facility

The Sanitary Landfill and Lead Facility was in the west-central portion of the current ALAAP – Area B and covered 7.5 acres. The landfill was used from the early 1940s until the late 1970s. Most of the fill material was domestic solid waste and building rubble (ESE 1981). However, both friable and Transite asbestos materials were mixed in the landfill soil. Asbestos contamination was estimated to cover 2.5 acres and occupy more than 21,000 cubic yards within the landfill. A Supplemental RI and baseline risk assessment indicated potential concerns for unrestricted use (i.e., residential) and ecological receptors at Study Area 3, but no concerns for the industrial and construction land use. An FS was conducted to evaluate elevated concentrations of metals in surface and subsurface soils at Study Area 3. The weight-of-evidence screening conducted as part of the FS concluded that metals were not a concern to ecological receptors. However, human health concerns remain for the unrestricted use of Study Area 3. Based on the FS evaluation, further protective measures are required to address the residential COCs at Study Area 3.

2.5.5 Study Area 4 – Manhattan Project Area

The Manhattan Project Area used a portion of ALAAP in the western part of the GSA Area from 1943 to 1945 (DA 1978). The Manhattan Project Area was designed to produce 1,600 pounds (192 gallons) of heavy water per month, but records indicate that it produced less than 600 pounds (72 gallons) per month (QORE 2002). A total of 11,160 pounds (1,338 gallons) of heavy water were produced from January 1944 through July 1945. The heavy water process did not involve any radioactive materials. In 1945 and 1946, all buildings were removed from the Manhattan Project Area except for one small brick building, which was removed in 1995. During the demolition, Transite asbestos was scattered over the area (ESE 1993). A Supplemental RI and baseline risk assessment conducted in 1995 identified lead as a COC for unrestricted land use (i.e., residential) and construction land use, and metals as ecological chemicals of concern (ecoCOCs). An FS was conducted to further evaluate the potential concerns for Study Area 4. Lead modeling conducted as part of the FS concluded that lead was not a concern for the future construction worker, and weight-of-evidence analysis concluded that metals are not a concern to ecological receptors. However, human health concerns remain for the unrestricted land use (i.e., residential). Further protective measures are required to address the residential COC (lead) at Study Area 4.

2.5.6 Study Area 5 – Red Water Storage Basin

The Red Water Storage Basin was constructed on the northern side of the Red Water Ditch, several hundred yards to the west of the Southern TNT Manufacturing Area (Study Area 6), and was intended to be used as a settling basin for TNT manufacturing process wastewaters. The basin covered an area of approximately 9 acres and was surrounded by a 6-foot clay berm. An entry pipe was at the southeast corner and an exit flume to the Red Water Ditch (Study Area 21) was in the southwest corner. The basin contains some water during even the driest periods of the year. A Supplemental RI was conducted in 1995 and concluded that there are no COCs for the unrestricted use (i.e., residential) or the industrial and construction land use at Study Area 5. Since no threats to human health or the environment exist at Study Area 5 based on unrestricted land use (i.e., residential), NFA is required.

2.5.7 Study Area 6 – Southern TNT Manufacturing Area

Study Area 6 was a TNT manufacturing area. Ditches were present where wooden flumes carried wastes to the industrial sewers when ALAAP was in operation. The production lines in this area were extensively bulldozed during demolition and all that remained as evidence of the former structures were the roadways and portions of building foundations. Contaminated soil initially situated adjacent to certain buildings was assumed to have been dispersed throughout the area in random patterns.

An environmental survey and RI identified potential explosives or explosives-related contamination in soil and groundwater. In addition, Transite-containing rubble from building demolition was around or near building foundations (QORE 2002).

Approximately 27,703 cubic yards of explosives-contaminated soils from Study Area 6 were excavated and incinerated in 1994 (Weston 1994 and 1996b). Soil contaminated with lead and ash residues remaining after thermal treatment were stabilized and then disposed of in a landfill (QORE 2002). Asbestos was removed to a secure repository. Approximately 14,000 linear feet of encased contaminated lines of the Industrial Sewer System, part of which flowed through Study Area 6, was excavated and decontaminated in 1994 (Weston 1996c). In addition, approximately 5,800 linear feet of nonencased contaminated industrial sewerline was deactivated, excavated, decontaminated, or incinerated (Weston 1996c). Confirmatory samples were collected to demonstrate that the contamination had been removed.

Since soils at Study Area 6 have been remediated, no remaining threats to human health or the environment exist based on unrestricted land use and NFA is required.

2.5.8 Study Area 7 – Northern TNT Manufacturing Area

The area consisted of four TNT production lines and a DNT production line. Red water, which is wastewater from the production of TNT that turned red after it was exposed to light, was discharged into the open Red Water Ditch. The locations of ditches indicate where wooden flumes formerly carried wastes to the industrial sewers. Like Study Area 6 to the south, this production area has been completely demolished. Construction debris material was spread over a wide area during the demolition, so only foundations and portions of the Industrial Sewer System remained after production activities ceased.

An environmental survey and RI identified potential explosives or explosives-related contamination in soil and groundwater. In addition, Transite-containing rubble from building demolition was around or near building foundations (QORE 2002).

Approximately 17,120 cubic yards of explosives-contaminated soils from Study Area 7 were excavated and incinerated in 1994 (Weston 1994 and 1996b). Soil contaminated with lead and ash residues remaining after thermal treatment was stabilized and then disposed of in a landfill (QORE 2002). Asbestos was removed to a secure repository. Approximately 14,000 linear feet of encased contaminated lines of the Industrial Sewer System, part of which flowed through Study Area 7, were excavated and decontaminated in 1994 (Weston 1996c). In addition, approximately 5,800 linear feet of nonencased contaminated industrial sewerline were deactivated, excavated, decontaminated, or incinerated (Weston 1996c). Confirmatory samples were collected to demonstrate that the contamination had been removed.

A Supplemental RI and baseline risk assessment conducted in 1995 concluded that there are no COCs for the industrial and construction land use at Study Area 7. The Technical Memorandum Justification for NFA for Phase I Transfer of ALAAP Study Areas 7, 8, 9, 10, 21, 25, and 26 (SAIC 2000b) concluded that NFA is required to protect human health and the environment based on the likely land use. However, there are remaining concerns for the unrestricted land use (i.e., residential) at Study Area 7 due to residual TNT concentrations in soil. Further protective measures are required to address the residential COC at Study Area 7.

2.5.9 Study Area 8 – Acid/Organic Manufacturing Area

Nitrobenzene (used to form aniline and N-N-dimethylaniline), concentrated nitric acid, oleum, and sodium sulfite (sellite) were produced at the Acid/Organic Manufacturing Area. A former sulfur burning pit also is in this area (DA 1978). The area currently covers 104 acres. Extensive earthworks over portions of the area exposed and mixed both Transite and friable asbestos from the former buildings with the soils (ESE 1993). The area containing the asbestos covers an estimated 200,000 square yards (41 acres) (ESE 1993). Sulfur residues up to 1 inch in diameter were exposed on the ground surface in the sulfur storage area (ESE 1981). Previous investigations (ESE 1993) identified an area of 27,000 square yards (5.5 acres) that was contaminated with sulfur and acid wastes. A Supplemental RI and baseline risk assessment conducted in 1995 identified nickel and iron as the COCs in soil based on the construction land use and metals and PAHs as COCs in soil based on unrestricted use (i.e., residential), and metals as ecoCOCs. No COCs were identified for the industrial land use. An FS was conducted to further evaluate the potential concerns at Study Area 8. The Technical Memorandum Justification for NFA for Phase I Transfer of ALAAP Study Areas 7, 8, 9, 10, 21, 25, and 26 (SAIC 2000b) and the weight-of-evidence screening conducted as part of the FS concluded that there are no concerns for human health (based on the industrial and construction land use) and the environment. However, there are remaining concerns for the unrestricted land use due to residual metals and PAH concentrations in soil. Further protective measures are required to address the residential COCs at Study Area 8.

2.5.10 Study Area 9 – Aniline Sludge Basin

The Aniline Sludge Basin covers approximately 20,000 square feet (0.5 acres) and was used to store liquid wastes and sludges from the production of aniline and oleum in the Acid/Organic Manufacturing Area (DA 1978). Wash water from acid tanks was collected in the basin between 1967 and 1968. The unlined basin was designed to collect spillage and some wastewater from the southwest portion of the plant and ash from the northern power plant also may have been disposed of in the basin. Neutralizing chemicals were used in the pond to equalize the pH. An industrial outfall is on the western side of the basin. Although the pond contains water year-round, it becomes shallow during the dry season, usually the summer months.

A recommendation from investigations at Study Area 9 was to remove tar-like material from the basin. This action was completed as a removal action, but it was not included in a ROD. Approximately 3,063 cubic yards of material were excavated and transported to Cedar Hill Landfill in Ragland, Alabama, which is permitted to receive hazardous waste. A valve pit was collapsed in place and backfilled. Lead ingots from other remedial actions at the site also were disposed of offsite. Confirmatory samples were collected to demonstrate that the contamination had been removed. Basin berm walls and clean fill were used to backfill the excavations and the area was seeded for erosion control (ECC 1999a).

A Supplemental RI and baseline risk assessment of surface water and sediment at Study Area 9 conducted in 1996 identified no concerns for the industrial and construction land use. The Technical Memorandum Justification for NFA for Phase I Transfer of ALAAP Study Areas 7, 8, 9, 10, 21, 25, and 26 (SAIC 2000b) concluded that NFA is required to protect human health and the environment based on the likely land use, and the weight-of-evidence screening conducted as part of the FS concluded that there are no remaining threats to human health or the environment for unrestricted land use at Study Area 9. Therefore, NFA is required for Study Area 9.

2.5.11 Study Area 10 – Tetryl Manufacturing Area (East and West)

The Tetryl Manufacturing Area consisted of 12 manufacturing lines where tetryl was produced in a two-step process by first sulfonating N,N-dimethylaniline and then nitrating the resulting intermediate. Extensive amounts of lead were used in the piping, floors, and fittings of the nitration houses (ESE 1981). The buildings have been razed and all that remains of each line are the concrete building foundations. Earthworks have scattered both friable and Transite asbestos associated with the buildings over the study area. The current investigation area covers 98 acres. During the Installation Assessment (DA 1978), explosives material was recovered from the soil surface.

During the course of SAIC's Supplemental RI, Study Area 10 was subdivided into Study Areas 10E and 10W. SAIC's investigation was limited to the eastern half of the study area, whereas Roy F. Weston conducted investigations in the western half of the study area in 1995 and confirmed that the soils contained significant tetryl contamination in the vicinity of the tetryl production lines, nitrating houses, and recovery houses. Excavation of the soils in the western half of the study area (i.e., 10W) was conducted in September through December 1995 and details are provided below.

The Supplemental RI and baseline risk assessment of Study Area 10E conducted in 1996 identified metals as COCs for human and ecological receptors. In addition, lead was identified as a COC to human and ecological receptors in the western part of Study Area 10. The Technical Memorandum Justification for NFA for Phase I Transfer of ALAAP Study Areas 7, 8, 9, 10, 21, 25, and 26 (SAIC 2000b) concluded that NFA is required at Study Area 10 based on the planned industrial reuse. At the time the Technical Memorandum was prepared, Study Area 10 was evaluated in its entirety (i.e., not evaluated as 10E and 10W). During the Roy F. Weston remediation of Study Area 10W, approximately 13,034 cubic yards of explosives-contaminated soils were excavated and incinerated in 1996 (Weston 1994 and 1996b). Soil contaminated with lead and ash residues remaining after thermal treatment was stabilized and then disposed of in a landfill (QORE 2002). Confirmatory samples were collected to demonstrate that the contamination had been removed.

An FS was conducted to further evaluate the potential concerns for unrestricted use at Study Area 10 (this included 10E and 10W). The weight-of-evidence screening conducted as part of the FS concluded that no remaining threats to human health or the environment exist for unrestricted land use (i.e., residential) at Study Area 10E. Therefore, NFA is required at Study Area 10E.

For Study Area 10W, there are remaining concerns to human health based on unrestricted use (i.e., residential), but no concern to ecological receptors. Further protective measures are required to address the residential COC (i.e., lead) at Study Area 10W.

2.5.12 Study Area 16 – Flashing Ground

The Flashing Ground covers 16.5 acres and consists of trenches that were used after World War II to burn combustible trash and explosives materials. Approximately 5,693 cubic yards of explosives soils from Study Area 16 were excavated and transported to the Transportable Incineration System for thermal treatment in 1996 (Weston 1996d and 1996e). Approximately 1,004 cubic yards of lead-contaminated soil were stabilized and then disposed of in a landfill along with ash residues remaining after the thermal treatment of the explosives-contaminated soil (ECC 1998). Confirmatory samples were collected to demonstrate that the contamination had been removed.

A Supplemental RI and baseline risk assessment of Study Area 16 conducted in 1996 identified metals, TNT, and PAHs as COCs based on human health and metals as COCs for ecological receptors. An FS was conducted to further evaluate the potential concerns with metals, TNT, and PAHs at Study Area 16. The weight-of-evidence screening conducted as part of the FS concluded that there are remaining concerns to human health based on unrestricted land use (i.e., residential). There are no concerns for the industrial and construction land use at Study Area 16. Further protective measures are required to address the residential COCs (i.e., metals, PAHs, and TNT) at Study Area 16.

2.5.13 Study Area 17 – Propellant Shipping Area

A records search conducted as part of the Installation Assessment identified an old farm well that was constructed before the Army acquired the land in the area of the Propellant Shipping Area. It was reported that the well was used to dispose of inert material (DA 1978). Forty-eight shipping houses in this area were used to store smokeless propellant prior to shipment. Thirteen of the 48 shipping buildings are on land that previously was sold as part of ALAAP – Area A (ESE 1981). Thirty-five buildings remain in Study Area 17. The current study area covers 126 acres.

Approximately 741 cubic yards of 2,4-DNT-contaminated soils from Study Area 17 were excavated to a depth of 2 feet below land surface (BLS) and incinerated in 1996 (Weston 1996a, 1996c, 1996d, and 1996e). Following remediation, confirmatory samples were collected just below the excavation depth to verify that remediation was adequate. Supplemental RI and remediation confirmatory sampling indicate that no explosives remain in the soil at concentrations greater than the certified reporting limit of 0.31 µg/g (SAIC 2001).

A Supplemental RI and baseline risk assessment of Study Area 17 conducted in 1996 identified metals as COCs for both human and ecological receptors. An FS was conducted to further evaluate the potential concerns with metals at Study Area 17. The weight-of-evidence screening conducted as part of the FS concluded that there are remaining concerns to human health based on unrestricted land use (i.e., residential). There are no concerns for the industrial and construction land use and the ecological receptors at Study Area 17. Further protective measures are required to address the residential COC (i.e., arsenic) at Study Area 17.

2.5.14 Study Area 18 – Blending Tower Area

The Blending Tower Area was an area approximately of 50 acres where smokeless powder was mixed to make it more homogeneous. During the blending operation, the powder was pneumatically moved to an upper bin and then dropped over an umbrella into a lower bin. This procedure was repeated twice (DA 1978).

Transite asbestos was found in this area around the foundations of demolished buildings. Bulldozing during building demolition scattered the Transite material. Friable asbestos was not found in this area. Asbestos contamination in this area is estimated to cover 25,000 square yards.

A Supplemental RI and baseline risk assessment identified metals as COCs in soils based on unrestricted human use (based on assumed residential use) and for ecological receptors at Study Area 18. However, likely human uses of the land (industrial and construction) were not a concern. An FS was conducted to evaluate elevated concentrations of metals in surface and subsurface soils at Study Area 18. The weight-of-evidence screening conducted as part of the FS concluded that there are remaining concerns to human health based on unrestricted use (i.e., residential), but no concerns for the ecological receptors at Study Area 18. Further protective measures are required to address the residential COC (i.e., arsenic) at Study Area 18.

2.5.15 Study Area 19 – Lead Facility

The Lead Facility was used during the ALAAP production years for pouring lead ingots (DA 1978). At the time of the Environmental Survey (ESE 1981), numerous large pieces of lead, some weighing several pounds, were identified on the soil surface in this area. Boulders containing lead cobbles were observed on the ground surface during the field reconnaissance of the RI (SAIC 2001). Sparse and stressed vegetation also was observed. The current study area covers 2.6 acres.

Approximately 1,623 cubic yards of lead-contaminated soils from Study Area 19 were excavated and stabilized in 1998 using an onsite pugmill (ECC 1998). Following remediation, confirmatory samples were collected just below the excavation depth to verify that remediation was adequate.

A Supplemental RI and baseline risk assessment of Study Area 19 conducted in 1996 identified arsenic as a COC based on protection of human health (based on assumed residential land use) and concluded that there are no concerns for the industrial and construction land use and the ecological receptors. An FS was conducted to further evaluate the potential concerns with arsenic at Study Area 19.

The weight-of-evidence screening conducted as part of the FS concluded that there are remaining concerns to human health based on unrestricted land use (i.e., residential). Further protective measures are required to address the residential COC (i.e., arsenic) at Study Area 19.

2.5.16 Study Area 20 – Rifle Powder Finishing Area

Limited information is available on the history of the Rifle Powder Finishing Area. The Exploratory Survey (ESE 1981) activities conducted at the study area included a visual asbestos survey. During this visual survey, Transite asbestos was found around all building foundations and scattered throughout the area. Friable asbestos was found along all former steamline routes. Asbestos-containing material (ACM) was identified covering an estimated area of 29.6 acres. The current study area covers 42 acres (ESE 1981).

A Supplemental RI and baseline risk assessment of Study Area 20 conducted in 1996 identified iron as a COC based on human health and other metals based on ecological receptors. An FS was conducted to further evaluate the potential concerns at Study Area 20. The weight-of-evidence screening conducted as part of the FS concluded that no threats to human health or the environment exist for the unrestricted land use. Therefore, NFA is required for Study Area 20.

2.5.17 Study Area 21 – Red Water Ditch

The Red Water Ditch carried the industrial process wastewaters produced by the manufacture of TNT (sometimes known as "red water") and collected industrial process wastes and surface runoff from the Acid/Organic Manufacturing Area (Study Area 8) and the Tetryl Manufacturing Area (Study Area 10) (DA 1978). As initially constructed, the ditch extended from the western side of the Tetryl Manufacturing Area through the Northern and Southern TNT Manufacturing Areas. Industrial wastes generated in the Acid Organic Manufacturing Area were discharged into the ditch immediately east of the Northern TNT Manufacturing Area (near the former Building 806C). The areas that drained to the Red Water Ditch were involved in the production of acids (sulfuric and nitric), organic compounds (diphenylamine, aniline, and N,N-dimethylaniline), and explosives and their process byproducts (TNT, DNT, and tetryl). Other organic compounds (benzene and toluene) and inorganic compounds (sodium, sulfite, sodium carbonate, and elemental sulfur) also were stored in these areas that fed the Red Water Ditch.

The Red Water Ditch was constructed with steep sides and varies from approximately 3 to 10 feet in depth. The ditch crosses other drainage systems through clay pipelines. The ditch contains flowing water only during wet seasonal periods. During dry periods, usually the summer months, the ditch contains water in varied locations. The ditch was cleaned at least once since its original construction. Sediments dredged from the ditch during the cleaning operations were deposited along the banks of the ditch. The Red Water Ditch drainage system ultimately discharges into the Coosa River (ESE 1981).

TNT-contaminated sediments from the lower portions of the northern tributary of Study Area 21 were excavated and incinerated in 1995 until concentrations reached 100 μg/g (Weston 1995a), but available documents do not provide the volume of soil that was remediated.

A Supplemental RI and baseline risk assessment of Study Area 21 conducted in 1996 did not identify any threats to human health based on exposures to soil, surface water, or sediment, but there were potential concerns about ingestion of fish from the Red Water Ditch by hypothetical residents and recreational receptors. In addition, the RI identified potential concerns with ecological species exposed to surface water and sediment at the Red Water Ditch. An FS was conducted to further evaluate the potential concerns at Study Area 21. Although the Technical Memorandum Justification for NFA for Phase I Transfer of ALAAP Study Areas 7, 8, 9, 10, 21, 25, and 26 (SAIC 2000b) concluded that NFA is required based on the planned industrial reuse, there are remaining concerns about ingestion of fish from the Red Water Ditch by hypothetical residents and recreational receptors. Further protective measures are required to address this concern at Study Area 21.

2.5.18 Study Area 22 – Demolition Landfill

This disposal area, near the Flashing Ground (Study Area 16), consists of a semi-circular landfill in a swale extending approximately 500 feet along Patrol Road. Rubble from demolition activities was dumped at this study area in a 50-foot-wide semi-circle around the edge of the swale to an average depth of approximately 6 feet. Soil contamination at this study area is attributed to burial of construction debris following the burning of buildings within Area B. Several hundred pounds of lead were found on the surface in the form of sheets, wire, and pipe. Large amounts of cast iron, stainless steel fittings, aluminum, Transite, and other rubble were partially buried by concrete and earth. Friable asbestos also was distributed in the soil of this area. Soil sampling identified lead residues at concentrations above background in two samples and a small concentration of tetryl.

A Supplemental RI and baseline risk assessment conducted in 1996 at Study Area 22 recommended capping the landfill (SAIC 2001). A synthetic membrane liner overlain by clay and seeded topsoil layers were placed over the landfill in October 1998 (ECC 1999b). Further protective measures, including restrictions on intrusive activities, and periodic maintenance are required to maintain the integrity of the engineered cap at Study Area 22.

2.5.19 Study Area 25 – Storage Battery/Demolition Debris

Study Area 25 was identified during the June 1985 site visit conducted as part of the RI (ESE 1986). Inspection of the disposal area indicated the presence of rubble and at least 20 heavy-duty lead-acid battery casings. The casings consisted of approximately 30 pounds of lead components in glass casings. Along with the batteries, three mercury switches, each containing 3 to 4 milliliters of liquid mercury metal, also were observed. The disposal area covers 2.4 acres and is in a steep, overgrown ditch that periodically is flooded by water from the Coosa River.

A Supplemental RI and baseline risk assessment conducted in 1996 identified iron and manganese as COCs in soils based on protection of human health for the unrestricted human use (i.e., assumed residential) and metals for ecological receptors. However, likely human uses of the land (industrial and construction) were not a concern. An FS was conducted to evaluate elevated concentrations of metals in soils at Study Area 25. The weight-of-evidence screening conducted as part of the FS concluded that no threats to human health or the environment exist for unrestricted land use. Therefore, NFA is required for Study Area 25.

2.5.20 Study Area 26 – Crossover Ditch

The Crossover Ditch drains surface waters from the Leaseback Area, the Rifle Powder Finishing Area, part of the northern and all of the southern portions of the Propellant Shipping Area, the southern portion of the Southern TNT Manufacturing Area, and the Sanitary Landfill and Lead Facility. Two beaver dams have been constructed on the Crossover Ditch—a small dam immediately east of the Series 223 Buildings and a larger dam south of the Southern TNT Manufacturing Area.

Although the Crossover Ditch drains areas that produced nitrocellulose and smokeless powder, the ditch also passes adjacent to other study areas on ALAAP and chemicals from other sources may enter the drainage. Other identified potential sources of chemicals included the coal pile at the Bowater, Inc. power plant, the Sanitary Landfill and Lead Facility, the pipe flashing area immediately east of the Sanitary Landfill and Lead Facility (Study Area 3), and the large industrial waste reservoir on Bowater, Inc. land directly south of the Rifle Powder Finishing Area (ESE 1981). The Crossover Ditch collects and discharges surface waters generated on or adjacent to ALAAP property into the Coosa River (ESE 1981).

A Supplemental RI and baseline risk assessment conducted in 1996 did not identify any potential threats to human health based on exposures to surface water or sediment, but there were potential concerns with ingestion of fish from the Crossover Ditch by hypothetical residents. In addition, the RI identified potential concerns with ecological species exposed to surface water and sediment at the Crossover Ditch. An FS was conducted to further evaluate the metals as COCs in surface water and sediment at Study Area 26. Although the Technical Memorandum Justification for NFA for Phase I Transfer of ALAAP Study Areas 7, 8, 9, 10, 21, 25, and 26 (SAIC 2000b) concluded that NFA is required based on the planned industrial reuse, there are remaining concerns about ingestion of fish from the Crossover Ditch by hypothetical residents. Further protective measures are required to address this concern at Study Area 26.

2.5.21 Study Area 27 – Beaver Pond Drainage System

The Beaver Pond Drainage System flows west between the Southern and Northern TNT Manufacturing Areas (Study Areas 6 and 7, respectively) and derives its name from two large beaver ponds that affected the original drainage system. The drainage originates in undeveloped areas south and east of the Tetryl Manufacturing Area. Potentially contaminated surface runoff in the Beaver Pond Drainage System originates from the southern end of the Tetryl Manufacturing Area and the shipping houses in the Propellant Shipping Area. Some surface drainage from the Acid/Organic Manufacturing Area, the Tetryl Manufacturing Area, and the Northern TNT Manufacturing Area enters the Beaver Pond Drainage System (ESE 1981). Water is retained at various stages throughout the year in these ponds, but they have emptied on occasion due to breaches in the dams.

A Supplemental RI and baseline risk assessment conducted in 1996 did not identify any potential threats to human health based on exposures to surface water or sediment. However, the RI identified metals as COCs in surface water and sediment at the Beaver Pond Drainage System for ecological species. An FS was conducted to further evaluate the potential concerns for ecological species exposed to metals in surface water and sediment at Study Area 27. The weight-of-evidence screening conducted as part of the FS concluded that no threats to human health or the environment exist for unrestricted land use. Therefore, NFA is required for Study Area 27.

2.5.22 Study Areas 31, 32, TC4A, and TC4B – Stockpiled Soils

Structures TC4A, TC4B, and a concrete slab contained contaminated soil that was excavated from study areas in Area A and then placed in Area B pending incineration. TC4A and TC4B were buildings and the concrete slab was a membrane-covered concrete storage pad. Contaminated soils from Area A were removed between 1986 and 1987. In February 1990, a tornado demolished Building TC4B. Soils from the demolished building were added to the concrete slab and secured with the membrane liner. In February 1991, an FS was conducted for the Stockpiled Soils area. The study concluded that explosives, lead, and asbestos contamination were present above regulatory limits. An FS was conducted in July 1991 and a ROD was released in December 1991 (Army designated OU 2) (U.S. Army 1991). The Selected Remedy for the Stockpiled Soils area was to thermally treat and dispose of the soil onsite. All soils have been treated, the buildings have been dismantled, and the slab has been decontaminated (Weston 1995b). The site has been remediated and no threats to human health or the environment exist for unrestricted land use. Therefore, NFA is required for Study Areas 31, 32, TC4A, and TC4B – Stockpiled Soils.

2.5.23 Building 6 – Coke Oven

The Coke Oven in Building 6 was partially constructed during the 1950s-era plant update, but was never finished. The structure included a concrete-covered pit of unknown dimensions beneath a concrete slab next to Building 6. The Earth Technology Corporation (TETC) Community Environmental Response Facilitation Act (CERFA) Report (TETC 1994) identified the pit as a former burning pad where transformer oil was poured onto copper wire to burn off the insulation covering the wire. It is not known whether the transformer oil contained polychlorinated biphenyls (PCBs). The concrete pad is still present; however, the pit is not visible.

A Supplemental RI and baseline risk assessment conducted in 1996 identified arsenic, iron, and manganese in soils as COCs based on unrestricted human use (i.e., assumed residential) and aluminum, arsenic, lead, and zinc based on protection of ecological receptors. However, likely human uses of the land (industrial and construction) were not a concern. An FS was conducted to evaluate elevated concentrations of metals in surface and subsurface soils at Building 6 – Coke Oven. The weight-of-evidence screening conducted as part of the FS concluded that there are remaining concerns to human health based on unrestricted land use (i.e., residential), but no concerns for the ecological receptors. Further protective measures are required to address the residential COC (i.e., arsenic) at Building 6 – Coke Oven.

2.5.24 Downed Utility Poles with Transformers

The visual survey conducted under CERFA identified 27 locations under and around utility poles with transformers where the soil was blackened and bare of vegetation (TETC 1994). None of the transformers had been tested for PCB contamination. With the exception of a utility pole near Building 227D in the Smokeless Powder Manufacturing Area (Study Area 2), all locations are in the GSA Area. Each location was assigned a site number corresponding to the closest building, as follows:

- 708A – Three utility poles on the north side
- 703E – Two utility poles on the northwest portion
- 703A – Two utility poles on the southwest and one on the southeast portion
- 2240 – Eight utility poles on the south side
- 2170 – One utility pole on the southeast and two on the south side
- 704Y – Three utility poles on the north side
- 717A – Two utility poles on the northeast and one on the southwest portion
- 715C – One utility pole on the southeast portion
- 227D – One utility pole on the north side (in the Smokeless Powder Manufacturing Area).

A Supplemental RI and baseline risk assessment conducted in 1996 identified PCBs in soils as COCs based on protection of human health and the environment. During the Supplemental RI, surface soil samples were collected from each of the 27 utility pole areas. Risks for the residential land use scenario exceeded one or more risk targets (SAIC 2001). The soils surrounding the utility poles were excavated and disposed of in September and October 1999 (USACE 1999), but available documents do not provide the volume of soil that was remediated. Since soil remediation has been completed, no threats to human health or the environment exist for unrestricted land use. Therefore, NFA is required for this study area.

2.5.25 Transformer Storage Building

TETC's CERFA Report noted that transformers were likely to have been stored at one time behind Building 2240 (an instrument shop) (TETC 1994). Evidence of stressed vegetation that would indicate a release was not noted during the visual inspection of the area. The report also stated that a leaking transformer was stored in Building 2180, part of the Manhattan Project Area (Study Area 4), and was removed in 1987. When demolition activities began in Area A in 1973 to 1974, the transformers removed from Area A were stored in Building 2180. When the transformers were removed later, contractor cleanup activities consisted of throwing absorbent on any liquids present. In addition, old transformers that were stored behind Building 708A (a cafeteria) were vandalized (TETC 1994).

A Supplemental RI and baseline risk assessment conducted in 1996 identified PCBs in soils near the utility poles (some of which were located near the Transformer Storage Building). The soils surrounding the utility poles were excavated and disposed of in September and October 1999 (USACE 1999), but available documents do not provide the volume of soil that was remediated. Since soils remediation has been completed, no threats to human health or the environment exist for unrestricted land use. Therefore, NFA is required for this study area.

2.5.26 Fertilizer and Pesticide Storage Building

TETC's CERFA Report identified Building 223B as an area that was used to store fertilizers and pesticides (TETC 1994). It was leased approximately 20 years ago from the Army by the Parker Fertilizer Company in Sylacauga, Alabama, for pesticide storage. By 1991, the contents of the building were removed prior to initiation of demolition activities at ALAAP. No releases associated with this building have been reported.

A Supplemental RI and baseline risk assessment conducted in 1996 did not indicate concerns associated with fertilizers or pesticides, but identified metals in soils as COCs based on protection of human health and the environment. An FS was conducted to evaluate elevated concentrations of metals in surface and subsurface soils around the Fertilizer and Pesticide Storage Building. The weight-of-evidence screening conducted as part of the FS concluded that no threats to human health or the environment exist for unrestricted land use. Therefore, NFA is required for this study area.

2.5.27 Gas Station and Underground Storage Tanks

TETC's CERFA Report identified a potential gas station in Area B (TETC 1994). Building 724E was reported by an Inventory of Military Real Property as a gas station without a building (i.e., pump stations). The only information available on the gas station stated that USTs associated with the station were installed in 1942 and all USTs reportedly have been removed.

At the Gas Station, no surface soil samples were collected and all chemicals detected in subsurface soil were less than background or risk-based concentrations. No threats to human health or the environment exist for unrestricted land use at the Gas Station; therefore, NFA is required for this study area.

TETC's CERFA Report also identified two 12,000-gallon USTs that were removed in 1993: one was near Building 302B (Ammonia/Oxidation Plant) and the other was near Building 715C (a flammable materials storehouse) (TETC 1994). One of the tanks contained gasoline and the other contained diesel fuel; it is uncertain which tank contained diesel and which contained gasoline (TETC 1994). During the Supplemental RI conducted in 1996, a third potential UST site was observed in the vicinity of Building 720D. This UST has been referred to as the Guard Post UST due to its proximity to the former Guard Post. This UST has been removed.

A limited amount of petroleum-contaminated soil (approximately 270 cubic yards) was removed and transported to the Shelby County Landfill in Columbiana, Alabama; approximately 330 gallons of sludge were removed from the tanks and disposed of at the Allwaste Recovery System in Fairburn, Georgia; and the tank excavation was backfilled with clean fill. Four of 10 samples collected to confirm that the contaminated soils had been completely removed contained concentrations of total petroleum hydrocarbons (TPH) above the cleanup criterion (100 parts per million [ppm]), but no additional sampling was conducted because the contract quantities would have been exceeded (EMC 1996).

A Supplemental RI and baseline risk assessment were conducted in 1996 to investigate the potential for residual fuel contamination resulting from the USTs and operations at the gas station. A variety of metals were detected in the soils near the former UST locations at concentrations greater than background. Iron and manganese in soils were identified as COCs based on unrestricted human use (i.e., assumed residential). Other human uses of the land (recreational, industrial, and construction) were considered unlikely and ecological receptors were not assumed to contact subsurface soil, so there were no other concerns. An FS was conducted to evaluate elevated concentrations of iron and manganese in soil in the vicinity of the USTs. The weight-of-evidence screening conducted as part of the FS concluded that no threats to human health or the environment exist for unrestricted land use. Therefore, NFA is required for the USTs.

2.5.28 South Georgia Road Dump

The Environmental Baseline Survey (EBS) identified a former dump area south of Old Georgia Road on the southeast corner of Area B between Study Areas 16 and 17 (SAIC 2000a). Debris observed in this area has included roofing shingles, powder can rings, randomly scattered slag from a nearby study area, and exposed and partially exposed rusted drums. In addition to the visible presence of surface and shallow subsurface debris, stressed vegetation was evident in the area. Vegetation was not present in the dump area in the center of young and mature pine trees. Significant concentrations of explosives or lead were not detected in groundwater samples from this area compared to other ALAAP wells (SAIC 2001).

An analysis of infrared aerial photography (Rome 1979) concluded that trees along Old Georgia Road had been bulldozed. Additional aerial photographic analysis (NAR 1949) indicated the dump as an area with large surface scarring devoid of vegetation, but recovery of the scarring and very sparse vegetation in later years (NAR 1954, USDA 1957 and 1962). Aerial photography taken after 1969 shows nearly complete recovery of the site with no observable scarring and extensive vegetation covering (USDA 1969, 1972, 1977, and 1993), but the presence of surface debris and stressed vegetation suggested the need for further evaluation of the former dump area.

Field investigations were conducted in 2001, 2002, and 2004 over a broad area of surface disturbance and debris observed at the site. The field investigations included intrusive sampling through shallow trenching combined with screening level soil surveys using X-ray fluorescence (XRF) analyses and confirmatory laboratory analyses. The results indicate that the observed debris is predominantly surficial and the debris was not observed at significant depth at the trenched locations, which were excavated to bedrock that ranged in depth from 2 to 5.5 feet BLS. The XRF screening and laboratory confirmation analyses indicate that the horizontal and vertical extent of lead contamination is fully delineated. Based on results of lead modeling to assess the potential for adverse health effects to human health, blood lead levels for industrial and construction workers at the 95 percentile are below the target criteria (10 μg/dL) for surface and subsurface soil and do not indicate the need for site remediation. Soil sampling was conducted in 2007 to verify that volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) were not a concern at the South Georgia Road Dump. Trace concentrations of VOCs and SVOCs were detected in the shallow soil. However, the concentrations were below preliminary remediation goals (PRGs) established for residential soil (SAIC 2007). Although this site was not evaluated in the FS, implementation of LUCs would be required at the South Georgia Road Dump because lead would remain in soil at concentrations exceeding residential criteria (i.e., unrestricted land use). Further protective measures are required to address the residential COC (i.e., lead) at the South Georgia Road Dump.

2.6 CURRENT AND POTENTIAL FUTURE LAND USE

Area B was under caretaker status until March 2003. Currently, Area B is being redeveloped as an industrial park by the city of Childersburg LRA. The Quitclaim deed for Area B includes a covenant within the environmental protection provisions that requires the future use of the property to be industrial with ancillary commercial, recreational, and natural habitat uses. The use restrictions are presented in Section III of "Exhibit C" of the Quitclaim deed. Groundwater use is restricted within Area B.

Land surrounding ALAAP – Area B includes a mixture of recreational and industrial use. The ALAAP property is surrounded as follows:

- ***North***—A wastewater pump and filter plant and light industrial park are to the north.
- ***East***—The McDonald Land Company is conducting wildlife management and research and plans to leave areas to the east of ALAAP undeveloped. This area was previously ALAAP – Area A.
- ***West***—The Coosa River flows to the west of ALAAP, which is bordered by a golf course.
- ***South***—An operational pulp and paper products plant owned by Bowater, Inc. (formerly Kimberly-Clark Corporation and formerly Alliance Forestry Products, Inc.), a coal-fired cogeneration facility, and a large coal storage facility are to the south of ALAAP.

2.7 SUMMARY OF SITE RISKS

Multiple assessments were conducted to determine which ALAAP – Area B study areas required further action. This section describes the human health risk assessment, the ecological risk assessment (ERA), and the weight-of-evidence assessment.

2.7.1 Conceptual Site Models

Exposure pathways describe the course a chemical or physical agent takes from the source to the exposed receptor. As a result, there are four components to an exposure pathway: a source and mechanism for release, a retention or transport medium, a point of potential contact with the contaminated medium, and an exposure route. The exposure pathways evaluated in the risk assessment are presented graphically in CSMs for humans (Exhibit 2-4) and ecological receptors (Exhibit 2-5).

2.7.2 Human Health Risk Assessment

The baseline risk assessment estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this site. Soil, sediment, and surface water samples were collected to examine the nature, magnitude, and extent of contamination at these study areas. Cancer and noncancer risks to humans were estimated for both current and future land uses.

2.7.2.1 Exposure Assessment

The baseline risk assessment addressed risks associated with the following scenarios: current/future industrial land use, future recreational land use, future residential land use, and future construction land use. The recreational and residential land use scenarios are hypothetical because there are no residents currently living on the site and residents are not expected to occupy the sites in the future. Exhibits 2-6 through 2-8 present the exposure scenarios evaluated for each study area and exposure assumptions used for each exposure scenario.

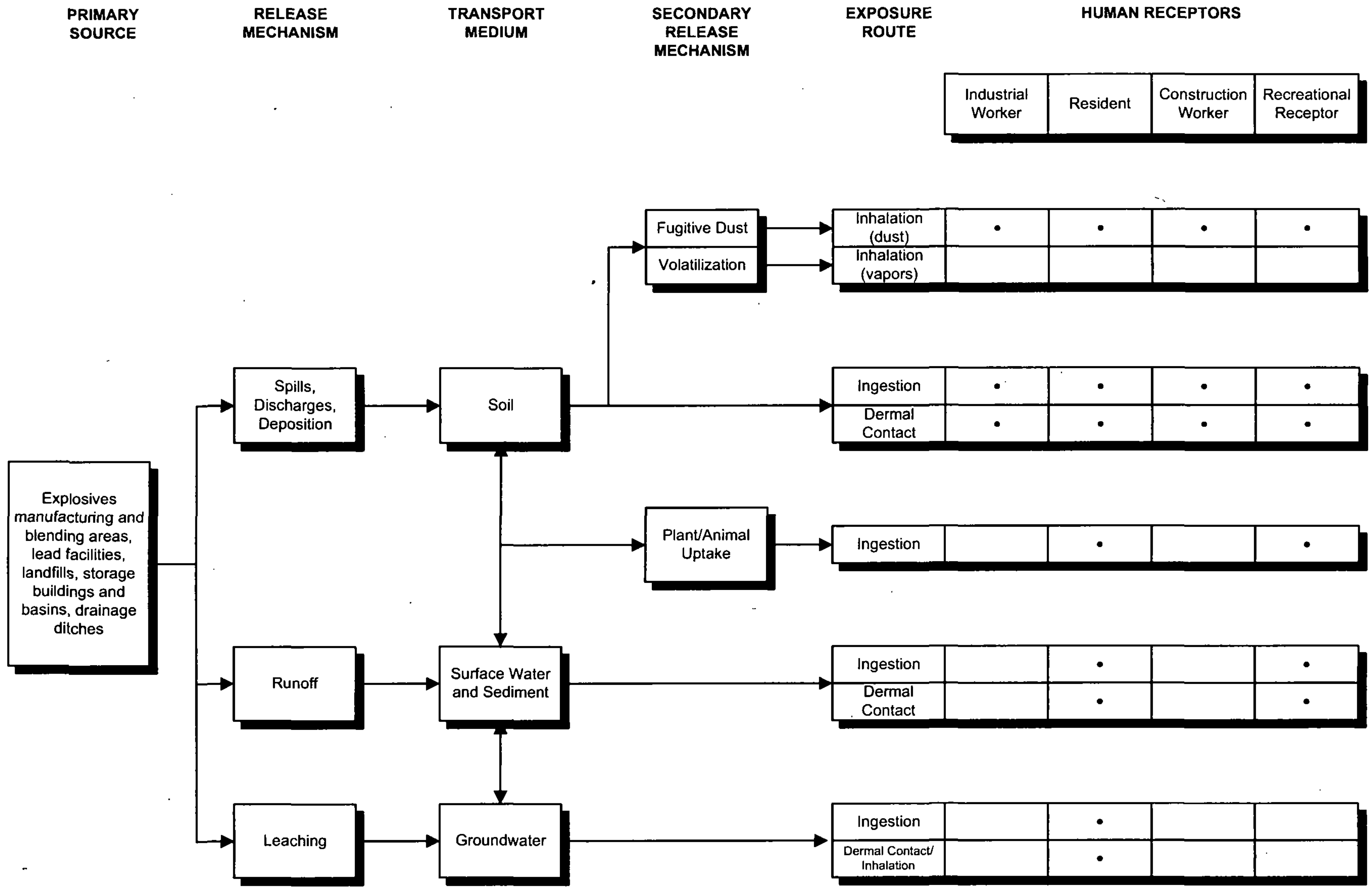
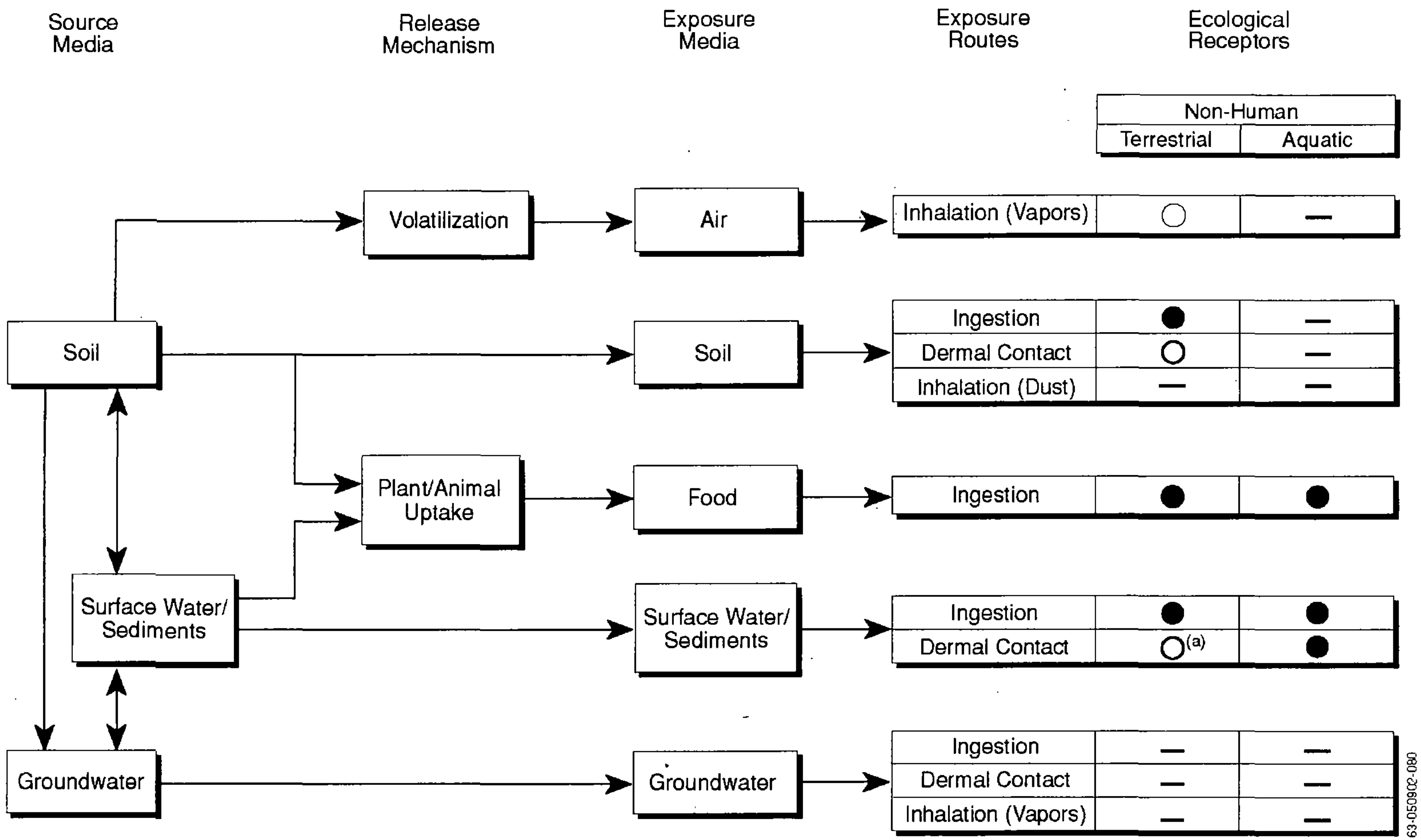


Exhibit 2-4. Conceptual Site Model for Human Health Risk Assessment
Alabama Army Ammunition Plant, Childersburg, Alabama



● Complete pathway evaluated quantitatively
○ Complete pathway evaluated qualitatively
— Incomplete pathway, not evaluated
(a) Surface water only

Exhibit 2-5. Conceptual Site Model for Ecological Risk Assessment
Alabama Army Ammunition Plant, Childersburg, Alabama

Exhibit 2-6. Exposure Pathways for the Human Health Risk Assessment Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area/ Exposure Unit	Land Use	Receptor	Soil			Surface Water[a]		Sediment[a]		Fish/Game[b]
			Ingestion	Dermal Contact	Particulate Inhalation	Ingestion	Dermal Contact	Ingestion	Dermal Contact	Ingestion
2 – Smokeless Powder Facility	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
3 – Sanitary Landfill and Lead Facility	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
4 – Manhattan Project Area	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
5 – Red Water Storage Basin	Current/Future	Industrial Worker								
	Future	Construction Worker								
	Future	Recreational Receptor						•	•	
	Future	Resident						•	•	
6 – Southern TNT Manufacturing Area	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
7 – Northern TNT Manufacturing Area	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
8 – Acid/Organic Manufacturing Area	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					•
	Future	Resident	•	•	•					•
8 – Test Pits	Current/Future	Industrial Worker								
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor								
	Future	Resident	•	•	•					

Exhibit 2-6. Exposure Pathways for the Human Health Risk Assessment Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

Study Area/ Exposure Unit	Land Use	Receptor	Soil			Surface Water[a]		Sediment[a]		Fish/Game[b]
			Ingestion	Dermal Contact	Particulate Inhalation	Ingestion	Dermal Contact	Ingestion	Dermal Contact	Ingestion
9 – Aniline Sludge Basin, Tar, Sediments Beneath Tar	Current/Future	Industrial Worker								
	Future	Construction Worker								
	Future	Recreational Receptor				•	•	•	•	
	Future	Resident				•	•	•	•	
10E – Tetryl Manufacturing Area	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					•
	Future	Resident	•	•	•					•
10W – Tetryl Manufacturing Area	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
16 – Flashing Ground	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•	•	•	•	•	•
	Future	Resident	•	•	•	•	•	•	•	•
17 – Propellant Shipping Area	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					•
	Future	Resident	•	•	•					•
18 – Blending Tower Area	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
19 – Lead Facility	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
20 – Rifle Powder Finishing Area	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					

Exhibit 2-6. Exposure Pathways for the Human Health Risk Assessment Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

Study Area/ Exposure Unit	Land Use	Receptor	Soil			Surface Water[a]		Sediment[a]		Fish/Game[b]
			Ingestion	Dermal Contact	Particulate Inhalation	Ingestion	Dermal Contact	Ingestion	Dermal Contact	Ingestion
21 – Red Water Ditch	Current/Future	Industrial Worker								
	Future	Construction Worker								
	Future	Recreational Receptor				•	•	•	•	•
	Future	Resident				•	•	•	•	•
22 – Demolition Landfill	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
25 – Storage Battery/Demolition Debris	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
26 – Crossover Ditch	Current/Future	Industrial Worker								
	Future	Construction Worker								
	Future	Recreational Receptor				•	•	•	•	•
	Future	Resident				•	•	•	•	•
27 – Beaver Pond Drainage System	Current/Future	Industrial Worker								
	Future	Construction Worker								
	Future	Recreational Receptor				•	•	•	•	•
	Future	Resident				•	•	•	•	•
Building 6 – Coke Oven	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
Transformer Storage Building and Utility Poles	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
Underground Storage Tanks	Current/Future	Industrial Worker								
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor								
	Future	Resident	•	•	•					

Exhibit 2-6. Exposure Pathways for the Human Health Risk Assessment
Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

Study Area/ Exposure Unit	Land Use	Receptor	Soil			Surface Water[a]		Sediment[a]		Fish/Game[b]
			Ingestion	Dermal Contact	Particulate Inhalation	Ingestion	Dermal Contact	Ingestion	Dermal Contact	Ingestion
Gas Station	Current/Future	Industrial Worker								
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor								
	Future	Resident	•	•	•					
Fertilizer and Pesticide Storage	Current/Future	Industrial Worker	•	•	•					
	Future	Construction Worker	•	•	•					
	Future	Recreational Receptor	•	•	•					
	Future	Resident	•	•	•					
South Georgia Road Dump	Current/Future	Industrial Worker	•							
	Future	Construction Worker	•							
	Future	Resident	•							
Talladega Creek[c]	Current/Future	Industrial Worker								
	Future	Construction Worker								
	Future	Recreational Receptor				•	•	•	•	•
	Future	Resident				•	•	•	•	•
Coosa River[c]	Current/Future	Industrial Worker								
	Future	Construction Worker								
	Future	Recreational Receptor				•	•	•	•	•
	Future	Resident				•	•	•	•	•

Blank spaces represent incomplete pathways.

[a] Surface water and sediment exposures were evaluated under a wading scenario.

[b] Ingestion of rabbit is evaluated at Study Areas 8, 10, 16, 17, and in background. Ingestion of fish is evaluated at Study Areas 21, 26, 27, Talladega Creek, and in background. Ingestion of crayfish is not evaluated in the human health risk assessment.

[c] Coosa River and Talladega Creek are evaluated as part of a separate groundwater investigation for ALAAP – Area B.

Exhibit 2-7. Exposure Assumptions for Current and Future Industrial Land Use Alabama Army Ammunition Plant, Childersburg, Alabama

Pathway	Assumption	Units	Current And Future Land Use			
			Worker			
			RME		CTE	
General	Body weight	kg	70	a	70	c
	Exposure duration	years	25	a	5	c
	Averaging time – noncancer	days	9125	a	1825	c
	Averaging time – cancer	days	25550	a	25550	c
Soil Ingestion	Ingestion rate	mg/day	50	a	50	c
	Bioavailability factor	none	1	g	1	g
	Exposure frequency	days/year	250	a	219	c
	Conversion factor	kg/mg	1.00E-06	-	1.00E-06	-
Soil Dermal Contact	Skin surface area available	cm^2/day	5800	b	5000	b
	Soil to skin adherence factor	mg/cm^2	1	b	0.2	b
	Dermal absorption factor	none	chemical-specific			d
	Exposure frequency	days/year	250	a	219	c
	Conversion factor	kg/mg	1.00E-06	-	1.00E-06	-
Fugitive Dust Inhalation	Inhalation rate	m^3/day	20	a	20	e
	Respirable particulate concentration (<=10μm)	mg/m^3	0.027	f	0.027	f
	Exposure frequency	days/year	250	a	219	c
	Conversion factor	kg/mg	1.00E-06	-	1.00E-06	-

[a] EPA 1991a, Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors

[b] EPA 1992, Dermal Exposure Assessment; for skin surface area available during soil dermal contact, assumes 25 percent of total body surface area is exposed (pp. 8-10 and 8-12 of EPA 1992a)

[c] EPA 1993, Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure

[d] A default value of 1.0 percent for organic compounds and 0.1 percent for inorganic chemicals was used (EPA Region IV guidance, EPA 1995)

[e] If guidance is not available for the CTE but exists for the RME, the RME value was conservatively adopted as the CTE

[f] Average 24-hour average PM_{10} concentration from Childersburg, Alabama air sampling station for the period 1/90 through 6/91 (ESE 1995)

[g] EPA 1995, EPA Region IV guidance

Note: Exposure assumptions for the adult lead model for the South Georgia Road Dump are shown in Exhibit 2-10

Exhibit 2-8. Exposure Assumptions for Residential, Recreational, and Construction Future Land Uses
Alabama Army Ammunition Plant, Childersburg, Alabama

PATHWAY ASSUMPTION	UNITS	FUTURE LAND USE																			
		Resident Children				Resident Adults				Recreational Children				Recreational Adults				Construction Workers			
		RME		CTE		RME		CTE		RME		CTE		RME		CTE		RME		CTE	
General																					
Body weight	kg	15	c	15	f	70	c	70	f	45	a	45	a	70	c	70	f	70	c	70	f
Exposure duration	years	6	c	2	f	24	c	7	f	10	a	10	a	24	c	7	f	2	h	1	i
Averaging time - noncancer	days	2190	c	730	f	8760	c	2555	f	3650	c	3650	c	8760	c	2555	f	730	c	365	f
Averaging time - cancer	days	25550	c	25550	f	25550	c	25550	f	25550	c	25550	c	25550	c	25550	f	25550	c	25550	f
Soil Ingestion																					
Ingestion rate	mg/day	200	c	100	f	100	c	50	f	100	b	50	b	100	c	50	f	480	c	240	i
Bioavailability factor	none	1	a	1	a	1	a	1	a	1	a	1	a	1	a	1	a	1	a	1	a
Exposure frequency	days/year	350	c	234	f	350	c	234	f	50	k	25	i	50	k	25	i	250	c	219	f
Conversion factor	kg/mg	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-
Soil Dermal Contact																					
Skin surface area available	cm^2/day	2010	e	1750	e	5800	e	5000	e	4100	e	3320	e	5800	e	5000	e	5800	e	5000	e
Soil to skin adherence factor	mg/cm^2	1	e	0.2	e	1	e	0.2	e	1	e	0.2	e	1	e	0.2	e	1	e	0.2	e
Dermal absorption factor	none	chemical-specific			g	chemical-specific			g	chemical-specific			g	chemical-specific			g	chemical-specific			g
Exposure frequency	days/year	350	c	234	f	350	c	234	f	50	k	25	i	50	k	25	i	250	c	219	f
Conversion factor	kg/mg	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-
Fugitive Dust Inhalation																					
Inhalation rate	m^3/day	15	a	15	j	20	c	20	f	13	b	13	j	9	b	9	j	24	b	20	c
Respirable particulate concentration	mg/m^3	0.027	m	0.027	m	0.027	m	0.027	m	0.027	m	0.027	m	0.027	m	0.027	m	0.027	m	0.027	m
Exposure frequency	days/year	350	c	234	f	350	c	234	f	50	k	25	i	50	k	25	i	250	c	219	f
Conversion factor	kg/mg	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-
Groundwater Ingestion																					
Ingestion rate	L/day	1	a	1	j	2	c	1.4	f	not evaluated								not evaluated			
Exposure frequency	days/year	350	c	234	f	350	c	234	f												
Conversion factor	mg/µg	1.00E-03	-	1.00E-03	-	1.00E-03	-	1.00E-03	-												
Groundwater Dermal Contact and Inhalation		Pathway evaluated in accordance with EPA Region IV guidance								not evaluated								not evaluated			
Sediment Ingestion (while wading)																					
Ingestion rate	mg/day	200	n	100	n	100	n	50	n	100	n	50	n	100	n	50	n	not evaluated			
Bioavailability factor	none	1	a	1	a	1	a	1	a	1	a	1	a	1	a	1	a				
Exposure frequency	days/year	45	a	23	i	45	a	23	i	25	k	13	i	25	k	13	i				
Conversion factor	kg/mg	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-				
Sediment Dermal Contact (while wading)																					
Skin surface area available	cm^2/day	2010	e	1750	e	5800	e	5000	e	4100	e	3320	e	5800	e	5000	e	not evaluated			
Sediment to skin adherence factor	mg/cm^2	1	n	0.2	n	1	n	0.2	n	1	n	0.2	n	1	n	0.2	n				
Dermal absorption factor	none	chemical-specific			n	chemical-specific			n	chemical-specific			n	chemical-specific			n				
Exposure frequency	days/year	45	a	23	i	45	a	23	i	25	k	13	i	25	k	13	i				
Conversion factor	kg/mg	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-				

Exhibit 2-8. Exposure Assumptions for Residential, Recreational, and Construction Future Land Uses Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

PATHWAY ASSUMPTION	UNITS	FUTURE LAND USE																	
		Resident Children				Resident Adults				Recreational Children				Recreational Adults				Construction Workers	
		RME		CTE		RME		CTE		RME		CTE		RME		CTE		RME	CTE
Surface Water Ingestion (while wading)																			
Ingestion rate	ml/hour	50	a	50	j	10	a	10	j	50	a	50	j	10	a	10	j	not evaluated	
Exposure time	hour/day	1	e	0.5	e	1	e	0.5	e	1	e	0.5	e	1	e	0.5	e		
Exposure frequency	days/year	45	a	23	i	45	a	23	i	25	k	13	i	25	k	13	i		
Conversion factor	mg/µg and L/ml	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-		
Surface Water Dermal Contact (while wading)																			
Skin surface area available	cm^2	2010	e	1750	e	5800	e	5000	e	4100	e	3320	e	5800	e	5000	e	not evaluated	
Permeability coefficient	cm/hour	chemical-specific			l	chemical-specific			l	chemical-specific			l	chemical-specific			l		
Exposure time	hour/day	1	e	0.5	e	1	e	0.5	e	1	e	0.5	e	1	e	0.5	e		
Exposure frequency	days/year	45	a	23	i	45	a	23	i	25	k	13	i	25	k	13	i		
Conversion factor	mg/µg and L/cm^3	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-	1.00E-06	-		
Rabbit Ingestion																			
Ingestion rate	kg/day	0.050	p	0.050	p	0.100	p	0.100	p	0.100	p	0.100	p	0.100	p	0.100	p	not evaluated	
Fraction ingested	none	1.0	o	1.0	o	1.0	o	1.0	o	1.0	o	1.0	o	1.0	o	1.0	o		
Exposure frequency	days/year	20	q	10	q	20	q	10	q	10	q	5	q	10	q	5	q		
Fish Ingestion																			
Ingestion rate	kg/day	0.03	p	0.03	p	0.03	p	0.03	p	0.03	p	0.03	p	0.03	p	0.03	p	not evaluated	
Fraction ingested	none	1	o	1	i	1	o	1	i	1	o	1	i	1	o	1	i		
Exposure frequency	days/year	120	r	120	r	120	r	120	r	120	r	120	r	120	r	120	r		

a - EPA 1995, EPA Region IV guidance

b - EPA 1989, Exposure Factors Handbook (EFH); the inhalation rate for construction workers was based on the reasonable worst-case outdoor inhalation rate of 3 m^3/hour and assuming an 8-hour work day; the inhalation rate for trespassers corresponds to approximately 4 hours of moderate activity per day

c - EPA 1991a, Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors

d - EPA 1991b, default values from Human Health Evaluation Manual, Part B

e - EPA 1992, Dermal Exposure Assessment; for skin surface area available during soil, sediment, and surface water dermal contact, assumes 25 percent of total body surface area is exposed (pp. 8-10 and 8-12 of EPA 1992a)

f - EPA 1993, Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure; the RME soil ingestion rate for the construction worker is for contact intensive activities

g - A default value of 1.0 percent for organic compounds and 0.1 percent for inorganic chemicals was used

h - The RME exposure duration for construction workers assumes 2 years of construction at an exposure unit

i - The CTE value has been estimated as one-half of the RME value

j - If guidance is not available for the CTE but does exist for the RME, the RME value was adopted as the CTE

k - For the recreational receptor, the RME frequency of exposure to soil corresponds to approximately 2 days per week for 6 months and the RME frequency of exposure to sediment and surface water under a wading scenario corresponds to approximately 1 day per week for 6 months

l - Dermal permeability constants used in this risk assessment are presented in Appendix J, Chemical-Specific Values Used in Evaluation of Dermal Exposure Pathways

m - Average 24-hour average PM_{10} concentration detected at the Childersburg, Alabama air sampling station for the period 1/90 through 6/91 (ESE 1995)

n - For sediment exposures, due to limited available information, the ingestion rate, adherence factor, and dermal absorption factor are the same as for soil exposures

o - Assumes that all rabbit and fish ingested is from the study area under investigation

p - The fish ingestion rate was taken from the Alabama Department of Environmental Management (ADEM); the adult and recreational child rabbit ingestion rate is the average ingestion rate for beef consumption in Exposure Factors Handbook (EPA 1989); the residential child ingestion rate is one-half the adult ingestion rate

q - Professional judgment

r - Assumes that fish is eaten on one-third of the days in the year

Note: Exposure assumptions for the adult lead model for the South Georgia Road Dump are shown in Exhibit 2-10

2.7.2.2 Toxicity Assessment

The objectives of the toxicity assessment are to evaluate the inherent toxicity of the compounds under investigation and to identify and select toxicity values for use in risk characterization. For the assessment of human health risks from exposure to chemicals, the following toxicity values were used:

- Reference doses (RfDs) for oral exposure – acceptable intake values for chronic exposure (noncancer effects)
- Reference concentrations (RfCs) for inhalation exposure – acceptable intake values for chronic exposure (noncancer effects)
- Cancer slope factors (CSFs) for oral exposure and inhalation route.

Toxicity information was preferably obtained from the Integrated Risk Information System (IRIS). If values were not available from IRIS, the Health Effects Assessment Summary Tables (HEAST) were consulted. In addition, provisional values from iron and aluminum were used.

2.7.2.3 Risk Characterization

Risk characterization combines the exposure and toxicity assessments by comparing estimates of intake or dose with appropriate toxicity values. The objective of the baseline risk characterization is to determine whether exposure to chemicals at the study areas under investigation pose risks that exceed target levels for human health effects.

The level of adverse noncarcinogenic effects from exposure to a given constituent is expressed as the hazard quotient (HQ). The HQ is the ratio of the estimated chronic daily intake of a chemical to the RfD. To evaluate exposure from more than one noncarcinogen, the chemical-specific HQs are summed for each exposure route in a given environmental medium to obtain the hazard index (HI). The HIs for each exposure route then may be summed within a medium. After the HIs for each medium are calculated, the HIs may be combined across all relevant media to estimate the total HI for each receptor.

Cancer risks are estimated as the incremental (site-specific) excess probability of an individual developing cancer over a lifetime (70 years) as a result of exposure to chemical carcinogens. Cancer risks are calculated by multiplying the average daily intake over a lifetime by the CSF for the carcinogen. The estimate of the total cancer risk must account for simultaneous exposure to multiple carcinogens, exposure routes, and media. To accomplish this, the cancer risks calculated for each individual carcinogen in an exposure route are summed to yield a cancer risk estimate for the exposure route.

For lead, biokinetic models were used to estimate blood levels of lead in resident children and adult workers. LEAD 0.99d (EPA 1994) is the model recommended by EPA for children and is based on uptake of lead originating from various sources in the environment. For adult workers, a model developed by EPA was used that is designed to evaluate and protect the fetuses of pregnant working women. Lead exposures pose an unacceptable risk if the blood lead level of the resident child, or the fetus of a female adult worker, exceeds the proposed benchmark concentration developed by the Centers for Disease Control and Prevention (CDC) (i.e., less than or equal to 10 μg/dL in 95 percent of the population). If blood lead levels exceed this guideline, study area exposures may present an unacceptable risk to human health.

The risk characterization summary for cancer and noncancer risks is presented for each study area in Exhibit 2-9. The results for the adult lead model for South Georgia Road Dump are shown in Exhibit 2-10.

Exhibit 2-9. Summary of Human Health Risks for ALAAP – Area B
Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area	Medium	Cancer Risk																Noncancer HI															
		Industrial Worker		Construction Worker		Recreational				Residential								Industrial Worker		Construction Worker		Recreational				Residential							
						Child		Adult		Child		Adult										Child		Adult		Child		Adult					
2	Surface Soil	8E-04	E	2E-04	E	3E-04	E	3E-04	E	3E-03	E	3E-03	E					9E-01	B	2E+00	E	2E-01	B	2E-01	B	7E+00	E	1E+00	B				
	Subsurface Soil	NA		1E-05	B	NA		NA		2E-04	E	2E-04	E					NA		2E+00	E	NA		NA		8E+00	E	2E+00	E				
3	Surface Soil	2E-05	B	1E-05	B	1E-05	B	1E-05	B	1E-04	B	1E-04	B					4E-01	B	2E+00	E	2E-01	B	1E-01	B	5E+00	E	8E-01	B				
	Subsurface Soil	NA		3E-08	B	NA		NA		9E-07	B	9E-07	B					NA		1E+00	B	NA		NA		4E+00	E	8E-01	B				
4	Surface Soil	1E-05	B	2E-06	B	4E-06	B	4E-06	B	3E-05	B	3E-05	B					3E-02	B	1E-01	B	1E-02	B	9E-03	B	4E-01	B	6E-02	B				
	Subsurface Soil	NA		6E-07	B	NA		NA		9E-06	B	9E-06	B					NA		8E-02	B	NA		NA		2E-01	B	7E-02	B				
8	Surface Soil and Rabbit	8E-05	B	2E-05	B	4E-05	B	4E-05	B	3E-04	E	3E-04	E					2E+00	E	6E+00	E	6E-01	B	4E-01	B	2E+01	E	3E+00	E				
	Subsurface Soil and Rabbit	NA		1E-06	B	4E-06	B	4E-06	B	2E-05	B	2E-05	B					NA		3E+00	E	4E-02	B	2E-02	B	8E+00	E	2E+00	E				
8 Test Pits	Surface Soil	NA		NA		NA		NA		NA		NA						NA		NA		NA		NA		NA		NA					
	Subsurface Soil	NA		1E-05	B	NA		NA		1E-04	B	1E-04	B					NA		8E+00	E	NA		NA		2E+01	E	3E+00	E				
9	Sediment and Surface Water	NA		NA		2E-05	B	2E-05	B	5E-05	B	5E-05	B					NA		NA		4E-01	B	3E-01	B	4E+00	E	5E-01	B				
9 Tar	Sediment	NA		NA		3E-03	E	3E-03	E	8E-03	E	8E-03	E					NA		NA		4E-01	B	3E-01	B	3E+00	E	5E-01	B				
10E	Surface Soil and Rabbit	7E-06	B	4E-06	B	8E-06	B	8E-06	B	6E-05	B	6E-05	B					2E+00	E	4E+00	E	5E-01	B	3E-01	B	1E+01	E	3E+00	E				
	Subsurface Soil and Rabbit	NA		9E-08	B	4E-06	B	4E-06	B	1E-05	B	1E-05	B					NA		2E+00	E	3E-02	B	2E-02	B	5E+00	E	1E+00	B				
10W	Surface Soil	1E-07	B	3E-08	B	4E-08	B	4E-08	B	4E-07	B	4E-07	B					4E-04	B	8E-04	B	1E-04	B	9E-05	B	3E-03	B	7E-04	B				
	Subsurface Soil	NA		NA		NA		NA		NA		NA						NA		1E-02	B	NA		NA		3E-01	B	6E-02	B				
16	Surface Soil, Surface Water, and Rabbit	3E-05	B	1E-05	B	1E-05	B	1E-05	B	2E-04	E	2E-04	E					6E-01	B	2E+00	E	2E-01	B	2E-01	B	6E+00	E	1E+00	B				
	Subsurface Soil, Surface Water, and Rabbit	NA		2E-06	B	8E-08	B	8E-08	B	3E-05	B	3E-05	B					NA		1E+00	B	3E-02	B	2E-02	B	3E+00	E	6E-01	B				
17	Surface Soil and Rabbit	2E-05	B	1E-05	B	2E-05	B	2E-05	B	1E-04	B	1E-04	B					1E+00	B	3E+00	E	4E-01	B	2E-01	B	1E+01	E	2E+00	E				
	Subsurface Soil and Rabbit	NA		1E-05	B	9E-06	B	9E-06	B	2E-04	E	2E-04	E					NA		1E+00	B	5E-02	B	3E-02	B	4E+00	E	8E-01	B				
18	Surface Soil	2E-05	B	9E-06	B	8E-06	B	8E-06	B	1E-04	B	1E-04	B					1E+00	B	3E+00	E	3E-01	B	2E-01	B	9E+00	E	2E+00	E				
	Subsurface Soil	NA		5E-08	B	NA		NA		1E-06	B	1E-06	B					NA		1E+00	B	NA		NA		4E+00	E	1E+00	B				
19	Surface Soil	8E-07	B	8E-08	B	1E-07	B	1E-07	B	2E-06	B	2E-06	B					1E-02	B	8E-03	B	4E-03	B	3E-03	B	8E-02	B	2E-02	B				
	Subsurface Soil	NA		1E-05	B	NA		NA		1E-04	B	1E-04	B					NA		8E-01	B	NA		NA		2E+00	E	3E-01	B				
20	Surface Soil	8E-06	B	4E-06	B	4E-06	B	4E-06	B	5E-05	B	5E-05	B					8E-02	B	5E-01	B	4E-02	B	2E-02	B	1E+00	B	2E-01	B				
	Subsurface Soil	NA		NA		NA		NA		NA		NA						NA		1E+00	B	NA		NA		4E+00	E	6E-01	B				
21	Sediment, Surface Water, and Fish	NA		NA		5E-04	E	5E-04	E	7E-04	E	7E-04	E					NA		NA		5E+00	E	3E+00	E	2E+01	E	3E+00	E				
21	Subsurface Sediment	NA		NA		5E-08	B	5E-08	B	1E-07	B	1E-07	B					NA		NA		1E-02	B	1E-02	B	9E-02	B	2E-02	B				
25	Surface Soil	8E-06	B	4E-06	B	4E-06	B	4E-06	B	5E-05	B	5E-05	B					3E-01	B	1E+00	B	1E-01	B	8E-02	B	4E+00	E	6E-01	B				
	Subsurface Soil	NA		NA		NA		NA		NA		NA						NA		5E-01	B	NA		NA		2E+00	E	5E-01	B				
26	Sediment, Surface Water, and Fish	NA		NA		4E-06	B	4E-06	B	1E-05	B	1E-05	B					NA		NA		8E-01	B	5E-01	B	3E+00	E	6E-01	B				
27	Sediment, Surface Water, and Fish	NA		NA		2E-06	B	2E-06	B	5E-06	B	5E-06	B					NA		NA		4E-01	B	2E-01	B	1E+00	B	3E-01	B				
B6	Surface Soil	8E-06	B	4E-06	B	4E-06	B	4E-06	B	5E-05	B	5E-05	B					2E-01	B	1E+00	B	9E-02	B	6E-02	B	3E+00	E	4E-01	B				
	Subsurface Soil	NA		1E-05	B	NA		NA		1E-04	B	1E-04	B					NA		2E+00	E	NA		NA		7E+00	E	1E+00	B				
US	Surface Soil	NA		NA		NA		NA		NA		NA						NA		NA		NA		NA		NA		NA					
	Subsurface Soil	NA		3E-07	B	NA		NA		5E-06	B	5E-06	B					NA		3E+00	E	NA		NA		8E+00	E	2E+00	E				
PS	Surface Soil	7E-06	B	4E-06	B	4E-06	B	4E-06	B	5E-05	B	5E-05	B					2E-01	B	1E+00	B	9E-02	B	6E-02	B	3E+00	E	4E-01	B				
	Subsurface Soil	NA		9E-08	B	NA		NA		2E-06	B	2E-06	B					NA		3E+00	E	NA		NA		8E+00	E	2E+00	E				

Surface Soil (0 to <1 ft BLS)
Subsurface Soil (1 to 10 ft BLS)
NA – pathway not evaluated or all detected chemicals eliminated as COPCs
B – HI < or =1 or ELCR < or = 10^{-4}
E – HI > 1 or ELCR > 10^{-}
Note: The adult lead model results for the South Georgia Road Dump are shown in Exhibit 2-10

Exhibit 2-10. Adult Lead Model Results for Workers at the South Georgia Road Dump Alabama Army Ammunition Plant, Childersburg, Alabama

Construction Worker

	Site Pb Conc. (mg/kg)	$PbB_{adult,0}$ (µg/dL)	BKSF /dL per µg/d	IR_S (g/day)	AF_S (unitless)	EF_S (day/yr)	AT (day)	$PbB_{adult,central}$ (µg/dL)	$GSD_{i,adult}$ (unitless)	$R_{fetal/maternal}$ (unitless)	$PbB_{fetal,0.95}$ (µg/dL)	Target=10 µg/dL Conclusion
SGRD surface soil	964	1.86	0.4	0.1	0.12	119	365	3.4	1.94	0.9	9.0	below target
SGRD subsurface soil	399	1.86	0.4	0.1	0.12	119	365	2.5	1.94	0.9	6.7	below target
RGO	1200	1.86	0.4	0.1	0.12	119	365	3.7	1.94	0.9	10.0	at target

Industrial Worker

	Site Pb Conc. (mg/kg)	$PbB_{adult,0}$ (µg/dL)	BKSF /dL per µg/d	IR_S (g/day)	AF_S (unitless)	EF_S (day/yr)	AT (day)	$PbB_{adult,central}$ (µg/dL)	$GSD_{i,adult}$ (unitless)	$R_{fetal/maternal}$ (unitless)	$PbB_{fetal,0.95}$ (µg/dL)	Target=10 µg/dL Conclusion
SGRD surface soil	964	1.86	0.4	0.05	0.12	219	365	3.2	1.94	0.9	8.7	below target
SGRD subsurface soil	399	1.86	0.4	0.05	0.12	219	365	2.4	1.94	0.9	6.5	below target
RGO	1300	1.86	0.4	0.05	0.12	219	365	3.7	1.94	0.9	10.0	at target

Conc. - concentration; soil concentration is the arithmetic mean of the data set
$PbB_{adult,0}$ - Baseline blood lead level - site specific value from Talladega County census data
BKSF - biokinetic slope factor - model default value
IR_s - ingestion rate - model default value for industrial workers; for construction workers, twice the model default was used
AF_s - adherence factor - model default
EF_s - exposure frequency - model default value for industrial workers; for construction workers, approximately one-half of a year was used
AT - averaging time - model default value
$PbB_{adult,central}$ - mean blood lead level - calculated value
GSD - geometric standard deviation - site-specific value from Talladega County census data was used
$R_{fetal/maternal}$ - factor that converts blood lead level in mother to blood lead level in fetus - model default
$PbB_{fetal,0.95}$ - mean blood lead level in fetus at 95th percentile - calculated value

Uncertainty is inherent in every step of the risk assessment process. Uncertainty is associated with the analytical data and creates the potential for either overestimating or underestimating risks to receptors. Uncertainty also is a part of the exposure assessment and primarily is associated with the exposure scenarios evaluated, the models used, and the exposure parameters used to estimate intake. In the baseline human health risk assessment, the industrial scenario is realistic and representative of current and likely future land use, whereas the residential land use scenario is unrealistic and unlikely. The models and exposure parameters used to estimate risk are fairly conservative because the assumptions used represent a reasonable maximum scenario.

Aspects of the toxicity assessment are uncertain. For example, the conditions under which the experimental studies used to derive the toxicity values are conducted are different from typical human exposure in an environmental setting. In general, the toxicity values tend to be conservative. However, toxicity values are not available for some chemicals and may contribute to the underestimation of risk. Overall, the uncertainty associated with the risk assessment may result in underestimation or overestimation of the actual risk by as much as an order of magnitude.

2.7.2.4 Chemicals of Concern

Exhibit 2-11 presents the COCs identified at the ALAAP – Area B study areas based on the human health risk assessments.

2.7.3 Ecological Risk Assessment

The ERA for the ALAAP – Area B study areas identified and evaluated the current and future risk to biota exposed under existing conditions to site-related contaminants detected in the surface soil, sediment, surface water, and biota (aquatic animals and small mammals) in accordance with EPA guidance (EPA 1997). Ecological risks were assessed at 25 study areas (ERAs were not conducted for the Stockpiled Soils and the South Georgia Road Dump). The screening-level ecological risk assessment (SERA) identified a variety of metals, organics, and explosive-related compounds as chemicals of potential ecological concern (COPECs) (i.e., HQs >1 with the conservative SERA assumptions) in the surface soil, sediment, and surface water at ALAAP – Area B. Based on the results of the SERA, a baseline ecological risk assessment (BERA) was conducted for all of the study areas to further evaluate identified COPECs using less conservative exposure and effects assumptions. The BERA identified metals and organics as COCs (i.e., HQs >1 with the refined BERA assumptions) for the surface soil, sediment, and surface water media. In addition, bioassays were conducted concurrently with the SERA and BERA. Findings from these site-specific bioassays were used to provide context to the SERA and BERA HQs and also were used to derive thresholds for ecological remedial goal options (ecoRGOs) when the observed no-effect concentration was greater than the ecoRGOs based on the published no-effect level. A summary of the ERA is presented in the sections below.

2.7.3.1 Screening-level Ecological Risk Assessment

COPECs were detected in the surface soil and surface water at all of the study areas (Exhibits 2-12 and 2-13 respectively). No COPECs were identified for the sediment at Study Areas 5 and 16 (Exhibit 2-14). COPECs in the surface soil, surface water, and sediment were evaluated further in the BERA. No further evaluation of ecological risk was conducted for sediment at Study Areas 5 and 16, as no COPECs were identified in these areas.

Exhibit 2-11. COCs for RME Risks at ALAAP – Area B
Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area	Medium	Land Use								Exceedance of MCL[a]
		Current/Future Industrial	Future Recreational	Future Residential	surf	subs	Future Construction	surf	subs	
2 - Smokeless Powder Facility	soil									
		arsenic	arsenic	arsenic	x		arsenic	x		
				chromium, hexavalent	x					
				iron	x	x				
				manganese	x	x				
		benzo(a)anthracene	benzo(a)anthracene	benzo(a)anthracene	x		benzo(a)anthracene	x		
		benzo(a)pyrene	benzo(a)pyrene	benzo(a)pyrene	x	x	benzo(a)pyrene	x		
		benzo(b)fluoranthene	benzo(b)fluoranthene	benzo(b)fluoranthene	x	x	benzo(b)fluoranthene	x		
		benzo(k)fluoranthene		benzo(k)fluoranthene	x					
		dibenzo(a,h)anthracene	dibenzo(a,h)anthracene	dibenzo(a,h)anthracene	x		dibenzo(a,h)anthracene	x		
				2,4-dinitrotoluene		x				
		indeno(1,2,3-cd)pyrene	indeno(1,2,3-cd)pyrene	indeno(1,2,3-cd)pyrene	x		indeno(1,2,3-cd)pyrene	x		
3 - Sanitary Landfill and Lead Facility	soil			arsenic	x					
				iron	x	x				
				manganese		x				
4 - Manhattan Project Area	soil			lead	x	x	lead	x		
5 - Red Water Storage Basin										
6 - Southern TNT Manufacturing Area										
7 - Northern TNT Manufacturing Area	soil			manganese		x				
				2,4,6-trinitrotoluene		x				
8 - Acid/Organic Manufacturing Area	soil			arsenic	x					
				iron	x	x				
				lead		x				
				manganese	x	x				
				nickel	x		nickel	x		
				benzo(a)anthracene	x					
				benzo(a)pyrene	x					
				benzo(b)fluoranthene	x					
				dibenzo(a,h)anthracene	x					
				indeno(1,2,3-cd)pyrene	x					
8 - Test pits	soil			antimony		x				
				arsenic		x				
				iron		x	iron		x	

Exhibit 2-11. COCs for RME Risks at ALAAP – Area B
Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

Study Area	Medium	Land Use								Exceedance of MCL[a]
		Current/Future Industrial	Future Recreational	Future Residential	surf	subs	Future Construction	surf	subs	
9 - Aniline Sludge Basin	sediment			iron	x					
9 - Tar	tar			iron	x					
				lead	x					
			N-nitrosodiphenylamine	N-nitrosodiphenylamine	x					
9 - Sediments beneath tar										
10 East - Tetryl Manufacturing Area	soil			iron	x	x				
		manganese		manganese	x	x	manganese	x		
10 West - Tetryl Manufacturing Area				lead	x					
16 - Flashing Ground	soil			arsenic	x					
				iron	x					
				lead	x	x	lead	x		
				benzo(a)anthracene	x					
				benzo(a)pyrene	x					
				benzo(b)fluoranthene	x					
				dibenzo(a,h)anthracene	x					
				indeno(1,2,3-cd)pyrene	x					
				2,4,6-trinitrotoluene		x				
17 - Propellant Shipping Area	soil			arsenic	x	x				
				iron	x					
				manganese	x	x	manganese	x		
18 - Blending Tower Area	soil			arsenic	x					
				iron	x					
				manganese	x	x				
19 - Lead Facility	soil			arsenic		x				
20 - Rifle Powder Finishing Area	soil			iron		x				
21 - Red Water Ditch	fish		arsenic	arsenic						
			Aroclor 1254	Aroclor 1254						

Exhibit 2-11. COCs for RME Risks at ALAAP – Area B
Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

Study Area	Medium	Land Use: Current/Future Industrial	Future Recreational	Future Residential	surf	subs	Future Construction	surf	subs	Exceedance of MCL[a]
22 - Demolition Landfill	soil			arsenic		x	arsenic		x	
				chromium, hexavalent		x				
				iron		x				
		lead		lead	x	x	lead	x	x	
				manganese		x				
				benzo(a)anthracene		x	benzo(a)anthracene		x	
				benzo(a)pyrene		x	benzo(a)pyrene		x	
				benzo(b)fluoranthene		x	benzo(b)fluoranthene		x	
				benzo(g,h,i)perylene		x				
				benzo(k)fluoranthene		x	benzo(k)fluoranthene		x	
				chrysene		x				
				dibenzo(a,h)anthracene		x	dibenzo(a,h)anthracene		x	
				indeno(1,2,3-cd)pyrene		x	indeno(1,2,3-cd)pyrene		x	
25 - Storage Battery/Demolition Debris	soil			iron	x					
				manganese		x				
26 - Crossover Ditch	fish			mercury						
27 - Beaver Pond Drainage System										
Building 6 - Coke Oven	soil			arsenic		x				
				iron	x	x				
				manganese		x				
Transformer Storage Building and Utility Poles	soil	Aroclor 1248		Aroclor 1248	x					
		Aroclor 1254		Aroclor 1254	x		Aroclor 1254	x		
		Aroclor 1260		Aroclor 1260	x					
Underground Storage Tanks	soil			iron		x				
				manganese		x				
Gas Station										
Fertilizer and Pesticide Storage	soil			iron	x	x	iron		x	
				manganese		x				
South Georgia Road Dump[c]	soil			lead	x	x				
Talladega Creek[b]										
Coosa River[b]										

[a] Includes both state and Federal MCLs
[b] Coosa River and Talladega Creek are evaluated as part of a separate groundwater investigation for ALAAP – Area B
[c] Recreational exposures were not evaluated at South Georgia Road Dump; residential exposures were evaluated for lead by comparison of site concentrations to the screening level of 400 mg/kg

Exhibit 2-12. Summary of Surface Soil COPECs (HQ >1) for ALAAP – Screen Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area	Range of Hazard Quotients			
	1 – 9	10 – 99	100 – 999	>1,000
2	Arsenic (2) vegetation Arsenic (2) cottontail Barium (1) cottontail Barium (4) shrew Barium (1) woodcock Lead (4) vegetation Manganese (3) vegetation Manganese (1) shrew Mercury (1) vegetation Vanadium (4) cottontail Vanadium (1) woodcock Zinc (4) vegetation Zinc (1) earthworm Zinc (1) shrew Acenaphthene (2) vegetation Benzo(a)pyrene (1) cottontail Benzo(a)pyrene (9) shrew Pyrene (3) vegetation Pyrene (3) earthworm	Aluminum (32) woodcock Arsenic (13) shrew Chromium (97) vegetation Chromium (20) woodcock Lead (26) shrew Vanadium (32) vegetation Vanadium (41) shrew Zinc (22) woodcock	Aluminum (514) vegetation Aluminum (174) cottontail Chromium (242) earthworm Lead (286) woodcock	Aluminum (1,460) shrew
3	Arsenic (4) vegetation Arsenic (5) cottontail Barium (1) cottontail Barium (5) shrew Barium (1) woodcock Cobalt (1) vegetation Cobalt (4) cottontail Copper (1) earthworm Lead (6) vegetation Vanadium (5) cottontail Vanadium (1) woodcock	Aluminum (36) woodcock Arsenic (26) shrew Lead (42) shrew Vanadium (40) vegetation Vanadium (52) shrew	Aluminum (580) vegetation Aluminum (197) cottontail Cobalt (155) shrew Lead (459) woodcock	Aluminum (1,640) shrew
4	Barium (4) shrew Lead (4) earthworm Lead (3) cottontail Zinc (4) vegetation Zinc (1) earthworm Zinc (1) shrew	Aluminum (35) woodcock Lead (36) vegetation Zinc (21) woodcock	Aluminum (559) vegetation Aluminum (189) cottontail Lead (236) shrew	Aluminum (1,580) shrew Lead (2,580) woodcock
6	Lead (1) shrew TNT (1) shrew	Lead (16) woodcock	None	None
7	Lead (3) shrew TNT (1) shrew	Lead (33) woodcock	None	None

Exhibit 2-12. Summary of Surface Soil COPECs (HQ >1) for ALAAP – Screen Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

Study Area	Range of Hazard Quotients			
	1 – 9	10 – 99	100 – 999	>1,000
8	Arsenic (2) vegetation Arsenic (3) cottontail Barium (4) shrew Cobalt (1) vegetation Cobalt (3) cottontail Copper (2) vegetation Copper (3) earthworm Copper (2) shrew Lead (8) vegetation Manganese (4) vegetation Manganese (2) shrew Molybdenum (5) vegetation Molybdenum (2) woodcock Nickel (4) cottontail Vanadium (5) cottontail Vanadium (1) woodcock Zinc (6) vegetation Zinc (2) earthworm Zinc (2) shrew	Aluminum (22) woodcock Arsenic (15) shrew Lead (52) shrew Molybdenum (22) shrew Nickel (55) earthworm Nickel (51) shrew Nickel (37) woodcock Vanadium (38) vegetation Vanadium (49) shrew Zinc (31) woodcock	Aluminum (350) vegetation Aluminum (119) cottontail Aluminum (993) shrew Cobalt (120) shrew Lead (563) woodcock Nickel (367) vegetation	None
10E	Arsenic (2) vegetation Arsenic (2) cottontail Barium (4) shrew Lead (5) shrew Manganese (8) vegetation Manganese (1) cottontail Manganese (4) shrew Benzoic acid (2) shrew	Arsenic (11) shrew Lead (53) woodcock	None	None
10W	Lead (9) vegetation	Lead (61) shrew	Lead (667) woodcock	
16	Arsenic (3) vegetation Arsenic (3) cottontail Barium (2) cottontail Barium (7) shrew Barium (2) woodcock Cadmium (2) earthworm Cadmium (1) cottontail Cobalt (1) vegetation Cobalt (3) cottontail Copper (4) cottontail Copper (7) woodcock Lead (4) earthworm Lead (4) cottontail Mercury (5) vegetation Mercury (1) woodcock Nickel (2) vegetation Vanadium (5) cottontail Vanadium (1) woodcock Zinc (4) vegetation Zinc (1) shrew	Aluminum (30) woodcock Arsenic (16) shrew Cadmium (64) vegetation Copper (16) vegetation Copper (32) earthworm Copper (21) shrew Lead (40) vegetation Vanadium (39) vegetation Vanadium (51) shrew Zinc (18) woodcock	Aluminum (480) vegetation Aluminum (163) cottontail Cadmium (174) shrew Cadmium (188) woodcock Cobalt (140) shrew Lead (264) shrew	Aluminum (1,360) shrew Lead (2,890) woodcock

Exhibit 2-12. Summary of Surface Soil COPECs (HQ >1) for ALAAP – Screen Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

Study Area	Range of Hazard Quotients			
	1 – 9	10 – 99	100 – 999	>1,000
17	Arsenic (5) vegetation Arsenic (5) cottontail Barium (1) cottontail Barium (4) shrew Barium (1) woodcock Manganese (5) vegetation Manganese (2) shrew	Aluminum (36) woodcock Arsenic (28) shrew	Aluminum (580) vegetation Aluminum (197) cottontail	Aluminum (1,640) shrew
18	Arsenic (4) vegetation Arsenic (5) cottontail Lead (3) shrew Manganese (4) vegetation Manganese (2) shrew Vanadium (5) cottontail Vanadium (1) woodcock	Arsenic (25) shrew Chromium (81) vegetation Chromium (16) woodcock Lead (34) woodcock Vanadium (38) vegetation Vanadium (50) shrew	Chromium (202) earthworm	None
19	Lead (1) vegetation Lead (8) shrew Zinc (4) woodcock	Chromium (22) woodcock Lead (89) woodcock	Chromium (107) vegetation Chromium (268) earthworm	None
20	Arsenic (2) vegetation Arsenic (2) cottontail Barium (2) shrew	Aluminum (28) woodcock Arsenic (13) shrew Chromium (66) vegetation Chromium (14) woodcock	Aluminum (449) vegetation Aluminum (152) cottontail Chromium (166) earthworm	Aluminum (1,270) shrew
22	Barium (3) vegetation Barium (5) cottontail Barium (5) woodcock Copper (3) cottontail Copper (4) woodcock Lead (5) earthworm Lead (5) cottontail Mercury (2) vegetation Nickel (3) vegetation Zinc (2) cottontail	Barium (20) shrew Cadmium (24) vegetation Cadmium (65) shrew Cadmium (70) woodcock Chromium (96) vegetation Chromium (20) woodcock Copper (10) vegetation Copper (20) earthworm Copper (14) shrew Lead (54) vegetation Zinc (86) vegetation Zinc (22) earthworm Zinc (26) shrew	Chromium (240) earthworm Lead (354) shrew Zinc (435) woodcock	Lead (3,880) woodcock
25	Arsenic (2) vegetation Arsenic (2) cottontail Lead (1) vegetation Lead (7) shrew Vanadium (5) cottontail Vanadium (1) woodcock Zinc (5) vegetation Zinc (1) earthworm Zinc (2) shrew Benzoic Acid (1) shrew	Aluminum (34) woodcock Arsenic (12) shrew Chromium (56) vegetation Chromium (11) woodcock Lead (74) woodcock Vanadium (39) vegetation Vanadium (50) shrew Zinc (27) woodcock	Aluminum (540) vegetation Aluminum (183) cottontail Chromium (139) earthworm	Aluminum (1,530) shrew

Exhibit 2-12. Summary of Surface Soil COPECs (HQ >1) for ALAAP – Screen Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

Study Area	Range of Hazard Quotients			
	1 – 9	10 – 99	100 – 999	>1,000
B6	Arsenic (2) vegetation Arsenic (2) cottontail Barium (3) shrew Lead (1) vegetation Lead (9) shrew Zinc (2) vegetation	Aluminum (36) woodcock Arsenic (13) shrew Lead (94) woodcock Zinc (11) woodcock	Aluminum (565) vegetation Aluminum (192) cottontail	Aluminum (1,600) shrew
PO	None	Aroclor-1254 (31) cottontail	Aroclor-1254 (594) woodcock	Aroclor-1248 (1,510) cottontail Aroclor-1248 (4,390) shrew Aroclor-1254 (1,010) shrew
PS	Arsenic (2) vegetation Arsenic (2) cottontail Barium (1) cottontail Barium (6) shrew Barium (1) woodcock Cadmium (2) vegetation Cadmium (6) shrew Cadmium (7) woodcock Chromium (9) woodcock Lead (3) vegetation Zinc (9) vegetation Zinc (2) earthworm Zinc (3) shrew	Aluminum (39) woodcock Arsenic (12) shrew Chromium (45) vegetation Lead (22) shrew Zinc (44) woodcock	Aluminum (615) vegetation Aluminum (208) cottontail Chromium (112) earthworm Lead (238) woodcock	Aluminum (1,740) shrew
BK	Lead (3) shrew Chromium (7) woodcock Zinc (3) woodcock	Chromium (35) vegetation Chromium (88) earthworm Lead (29) woodcock	None	None

Exhibit 2-13. Summary of Surface Water COPECs (HQ >1) for ALAAP – Screen Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area	Range of Hazard Quotients			
	1 – 9	10 – 99	100 – 999	>1,000
9	Copper (1) aquatic biota Iron (2) aquatic biota Lead (1) aquatic biota	None	None	None
16	2,4-DNT (5) mink TNT (6) mink	Cobalt (47) aquatic biota Cobalt (59) mink Iron (11) aquatic biota Manganese (10) aquatic biota	None	None
21	Aluminum (2) mink Arsenic (3) mink Iron (5) aquatic biota Lead (2) aquatic biota Manganese (1) mink Carbon disulfide (3) aquatic biota	Aluminum (25) aquatic biota Barium (17) aquatic biota Manganese (15) aquatic biota	None	None
26	Aluminum (1) mink Arsenic (2) mink Iron (5) aquatic biota Manganese (2) mink Carbon disulfide (3) aquatic biota	Aluminum (15) aquatic biota Barium (17) aquatic biota Manganese (29) aquatic biota	None	None
27	Iron (6) aquatic biota Lead (2) aquatic biota 2,4-DNT (3) mink Manganese (4) mink	Aluminum (14) aquatic biota Barium (15) aquatic biota Manganese (53) aquatic biota TNT (24) mink	None	None
CO*	Aluminum (6) aquatic biota	None	None	None
TA*	None	None	None	None
BK	Aluminum (4) aquatic biota Manganese (2) aquatic biota	None	None	None

* Coosa River and Talladega Creek are evaluated as part of a separate groundwater investigation for ALAAP – Area B.

Exhibit 2-14. Summary of Sediment Ecological COPECs (HQ >1) for Sediment-dwelling Biota at ALAAP – Screen
Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area	Range of Hazard Quotients			
	1 – 9	10 – 99	100 – 999	>1,000
5	None	None	None	None
9	Chromium (8) Lead (4) Manganese (4) Nickel (8) Zinc (4) Benzo(g,h,i)perylene (1) Benzo(k)fluoranthene (1) Chrysene (6) Ideno(1,2,3-cd)pyrene (1)	Arsenic (27) Copper (33)	None	None
16	None	None	None	None
21	Arsenic (4) Chromium (2) Copper (2) Lead (1) Manganese (6) Mercury (1) Nickel (1) Acetone (6) Pyrene (1)	None	None	None
26	Arsenic (6) Chromium (1) Copper (1) Lead (1) Manganese (3) Acetone (4) Benzo(k)fluoranthene (1)	None	None	None
27	Arsenic (2) Chromium (2) Lead (2) Manganese (4) Mercury (2) Zinc (5)	None	None	None
CO*	Copper (3) Lead (1) Mercury (6)	None	None	None
TA*	Arsenic (2) Lead (4) Manganese (4)	None	None	None
BK	Arsenic (1) Copper (2) Lead (1) Manganese (2) Nickel (1) Zinc (1) Acetone (3) Pyrene (1)	None	None	None

*Coosa River and Talladega Creek are evaluated as part of a separate groundwater investigation for ALAAP – Area B.

2.7.3.2 BERA Problem Formulation

COPECs that were identified in the SERA were further evaluated in the BERA. The BERA evaluated exposures to both terrestrial and aquatic receptors. Exhibit 2-15 provides information about the exposure routes. The problem formulation was the same between the SERA and BERA. The terrestrial receptors were immobile, soil dwelling organisms (vegetation and earthworms) and mobile, nonsoil dwelling organisms (shrews, rabbits, woodcocks, deer, foxes, and hawks). The aquatic receptors were rooted and floating vegetation, crayfish, fish, heron, and mink. Because there were no pathways for air or groundwater, no ecological risk calculations were made for these media. As shown in the CSM, ecological receptors at ALAAP are exposed to potentially hazardous chemicals in soil, surface water, sediment, or food over several pathways (Exhibit 2-5). The exhibit shows the exposure pathways for terrestrial and aquatic receptors.

2.7.3.3 BERA Study Design and Data Quality Objectives

In addition to surface soil, surface water, and sediment data, the BERA used site-specific biological data, including bioassays, tissue concentrations, and field-observed effects. For bioassays, soil samples were used for earthworm growth and mortality and plant germination, sediment samples were used for sediment-dweller growth and mortality, and surface water samples were used for water-flea growth and mortality. Bioassay results were used directly to help confirm ecological risk and especially to establish ecological RGOs for soil dwelling and sediment dwelling receptors. Tissue concentrations and field-observed effects supported or provided contexts and numbers for the ERA.

2.7.3.4 BERA Risk Characterization

The re-evaluation of COPECs identified in the SERA for the ALAAP – Area B study areas identified the potential for adverse effects to ecological receptors at 17 of the 18 study areas from COCs in the surface soil, 6 of 8 study areas from COCs in the sediment, and all of the study areas from COCs in the surface water. The re-evaluation eliminated the surface soil COPECs at Study Area 19 and the sediment COPECs at Study Areas 5 and 16. The re-evaluation of COPECs was based on measured site and RfCs, site-specific information on exposure pathways, published toxicity benchmarks, and modeled and predicted exposure to wildlife receptors, which was similar to the site-specific prey tissue concentrations.

For soil, the ecoCOCs consisted of 14 metals and 2 organics (PCBs). The highest risk quotients (quotients exceeding 100) were associated with aluminum and lead at a few study areas. There is little or no risk at Study Areas 6, 7, and 10. In sediment, the ecoCOCs consisted of eight metals and six organics. For sediment, the highest HQs (i.e., between 10 and 99) were associated with arsenic and copper at Study Area 9. In surface water, the ecoCOCs consisted of seven metals and one organic chemical. The highest HQs (i.e., between 10 and 99) were associated with the metals aluminum, barium, cobalt, and manganese at Study Areas 16, 21, 26, and 27.

Based on the results of the ERA, further evaluation in an FS was recommended from an ecological perspective for 12 surface soil study areas (Study Areas 2, 3, 4, 8 [Manufacturing Area], 10, 16, 17, 18, 20, 25, Coke Oven, and the Fertilizer and Pesticide Storage Building), 4 sediment study areas (Study Areas 9 [surface sediments], 21, 26, and 27), and 5 surface water study areas (Study Areas 9, 16, 21, 26, and 27). The FS focused on BERA COCs with HQs greater than or equal to 10. As a result of the ERA, no further evaluation was recommended for nine soil study areas (Study Areas 6, 7, 8, 19, 22, Downed Utility Poles, Transformer Storage Building, USTs, and the Gas Station), and four sediment study areas (Study Areas 5, 9 [tar area], 9 [sediments below tar], and 16). These sites were recommended for NFA as the sites were remediated, no COCs were present with HQs above 10, bioassay data supported the absence of adverse ecological effects, or the area was being evaluated as part of a separate groundwater investigation.

Exhibit 2-15. Exposure Routes
Alabama Army Ammunition Plant, Childersburg, Alabama

TERRESTRIAL UNITS		EXPOSURE ROUTE			
		Soil			
Exposure Unit	Receptor Class	Direct Contact	Ingestion	Ingestion of Plants	Ingestion of Animals
2 – Smokeless Powder Facility 3 – Sanitary Landfill and Lead Facility 4 – Manhattan Project Area 6 – Southern TNT Manufacturing Area 7 – Northern TNT Manufacturing Area 8 – Acid/Organic Manufacturing Area 10E – Tetryl Manufacturing Area--East 16 – Flashing Ground 17 – Propellant Shipping Area 18 – Blending Tower Area 19 – Lead Facility 20 – Rifle Powder Finishing Area 22 – Demolition Landfill 25 – Storage Battery/Demolition Debris B6 – Building 6 – Coke Oven PO – Downed Utility Poles PS – Fertilizer and Pesticide Storage Area Background in northeast part of Area A	Terrestrial Vegetation	•	—	—	—
	Soil-dwelling Invertebrates	•	•	—	—
	Herbivorous Animals	—	•	•	—
	Insectivorous Mammals and Birds	—	•	—	•
	Top Predators	—	—	—	•
AQUATIC UNITS		**EXPOSURE ROUTE**			
		Sediment and Surface Water			
Exposure Unit	**Receptor Class**	**Direct Contact**	**Ingestion**	**Ingestion of Plants**	**Ingestion of Animals**
5 – Red Water Storage Basin 9 – Aniline Sludge Basin 16 – Flashing Ground 21 – Red Water Ditch 26 – Crossover Ditch 27 – Beaver Pond Drainage System Talladega Creek Background (Fanning Creek) Background (Talladega Creek)	Aquatic Vegetation	—	—	—	—
	Sediment-dwelling Invertebrates	•	•	—	—
	Aquatic Animals	•	•	•	•
	Piscivorous Predators	—	—	—	•

• – = Pathway evaluated quantitatively
— = Pathway not evaluated or evaluated qualitatively

2.7.3.5 Chemicals of Concern

Exhibits 2-16 through 2-18 present the COCs identified at the ALAAP – Area B study areas based on ERAs.

2.7.4 Weight-of-Evidence Summary

The weight-of-evidence evaluation was used to help risk managers determine the appropriate human health and ecoCOCs for further evaluation in the FS. The weight-of-evidence used the results of the human health and ecological risk assessments, as well as relevant nature and extent information, to select the COCs that were evaluated further in the FS. Media included in the weight-of-evidence evaluation were soil, surface water, sediment, and fish tissue. Each COC at every study area in soil, surface water, sediment, and fish tissue was evaluated in the weight-of-evidence screening using the following eight criteria:

- ***Known History of Use***—If process knowledge confirms that the chemical was used or is associated with use (e.g., PAHs from the controlled burning program) at a study area, the chemical was retained for further analysis; otherwise, it was eliminated.
- ***Frequency of Detection***—If the chemical was detected in at least 5 percent of the samples collected from the study area, the chemical was retained for further analysis; otherwise, it was eliminated. There must be a minimum of 21 samples to fulfill this criterion.
- ***Comparison with Background***—If an inorganic chemical exceeded background, the chemical was retained for further analysis; otherwise, it was eliminated.
- ***Confidence in Toxicity Data***—Screening based on confidence in toxicity data was conducted separately for human health and ecological chemicals because different toxicity data are used to assess adverse health effects for humans than those used for ecological species. If the confidence in the toxicity data used to assess risk was high (e.g., EPA-approved toxicity value), the chemical was retained for further analysis; otherwise, it was eliminated.
- ***Confidence in Ecological Exposure Data***—If there was high confidence in the ecological exposure data, the chemical was retained for further analysis; otherwise, it was eliminated.
- ***Significance of Magnitude of Risk***—If the magnitude of risk was high (e.g., reasonable maximum [upper-bound] and central tendency [more likely] exposures both exceeded targets), the chemical was retained for further analysis; otherwise, it was eliminated.
- ***Ground-truthing Evidence of Adverse Impacts***—If there is direct and indirect evidence of ecological stresses in the study area (e.g., chlorotic or stunted vegetation, areas devoid of vegetation, low or no observed wildlife, and simple functional ecological system), the chemical was retained for further analysis; otherwise, it was eliminated. This criterion does not apply to human health-based COCs.
- ***Habitat Availability with Likely Future Land Use***—If vegetation to support wildlife species will remain in abundance, the chemical was retained for further analysis; otherwise, it was eliminated. This criterion does not apply to human health-based COCs.

Exhibit 2-19 summarizes the COCs retained at each study area following the weight-of-evidence assessment.

Several study areas were eliminated from further evaluation in the FS through the weight-of evidence screening. They include Study Areas 9, 10E, 20, 25, 27, Fertilizer and Pesticide Storage, and the USTs.

Exhibit 2-16. Summary of Surface Soil COCs (HQ >1) for ALAAP – Baseline Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area	Range of Hazard Quotients			
	1 – 9	10 – 99	100 – 999	>1,000
2	Aluminum (3) woodcock Arsenic (2) vegetation Barium (4) woodcock Lead (1) vegetation Manganese (2) vegetation Vanadium (2) shrew Zinc (2) vegetation	Aluminum (34) cottontail Aluminum (96) shrew Chromium (36) vegetation Lead (11) woodcock Vanadium (27) vegetation	Aluminum (391) vegetation	None
3	Arsenic (4) vegetation Arsenic (1) cottontail Arsenic (2) shrew Cobalt (1) vegetation Lead (4) vegetation Lead (1) shrew Lead (3) woodcock Vanadium (2) shrew	Vanadium (34) vegetation	None	None
4	Lead (3) shrew Lead (3) woodcock Zinc (2) vegetation	Aluminum (16) cottontail Lead (10) vegetation	Aluminum (434) vegetation Aluminum (107) shrew	None
6	Lead (2) woodcock	None	None	None
7	Lead (2) woodcock	None	None	None
8	Aluminum (2) woodcock Arsenic (2) vegetation Barium (4) woodcock Lead (3) vegetation Manganese (3) vegetation Molybdenum (3) vegetation Nickel (5) earthworm Nickel (1) shrew Nickel (2) woodcock Vanadium (2) shrew Zinc (2) vegetation	Aluminum (27) cottontail Aluminum (77) shrew Lead (21) woodcock Nickel (34) vegetation Vanadium (32) vegetation	Aluminum (313) vegetation	None
10E	Barium (2) woodcock Lead (3) woodcock Manganese (4) vegetation	None	None	None
10W	Lead (5) vegetation Lead (2) shrew	Lead (31) woodcock	None	None
16	Arsenic (3) vegetation Arsenic (1) shrew Barium (1) woodcock Cadmium (2) earthworm Cadmium (8) shrew Cadmium (2) woodcock Copper (8) vegetation Copper (2) cottontail	Aluminum (27) cottontail Aluminum (77) shrew Cadmium (64) vegetation Copper (16) earthworm Lead (54) vegetation Lead (17) shrew Lead (78) woodcock Vanadium (25) vegetation	Aluminum (316) vegetation	None

Exhibit 2-16. Summary of Surface Soil COCs (HQ >1) for ALAAP – Baseline Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

Study Area	Range of Hazard Quotients			
	1 – 9	10 – 99	100 – 999	>1,000
16 (cont.)	Copper (3) shrew Lead (5) earthworm Mercury (5) vegetation Nickel (1) vegetation Vanadium (2) shrew Zinc (3) vegetation	None	None	None
17	Aluminum (3) woodcock Arsenic (5) vegetation Arsenic (1) cottontail Arsenic (2) shrew Barium (5) woodcock Manganese (3) vegetation	Aluminum (35) cottontail	Aluminum (410) vegetation Aluminum (101) shrew	None
18	Arsenic (1) vegetation Manganese (2) vegetation Vanadium (1) shrew	Chromium (32) vegetation Chromium (79) earthworm Vanadium (23) vegetation	None	None
19	None	None	None	None
20	Aluminum (1) woodcock Arsenic (1) vegetation Barium (1) woodcock	Aluminum (30) cottontail Aluminum (87) shrew Chromium (40) vegetation	Aluminum (352) vegetation Chromium (100) earthworm	None
22	Lead (3) earthworm Lead (8) shrew Lead (4) woodcock Mercury (2) vegetation Nickel (2) vegetation Zinc (3) shrew	Lead (26) vegetation Zinc (11) earthworm	None	None
25	Arsenic (2) vegetation Vanadium (2) shrew Zinc (3) vegetation	Chromium (45) vegetation Vanadium (28) vegetation	Chromium (114) earthworm	None
B6	Aluminum (1) cottontail Arsenic (2) vegetation Lead (1) vegetation Zinc (2) vegetation	Aluminum (25) shrew	Aluminum (512) vegetation	None
PO	Aroclor-1248 (3) shrew Aroclor-1254 (4) shrew	None	None	None
PS	Aluminum (2) cottontail Arsenic (1) vegetation Cadmium (1) vegetation Lead (2) vegetation Zinc (5) vegetation Zinc (1) earthworm	Aluminum (47) shrew Chromium (26) vegetation Chromium (65) earthworm	Aluminum (488) vegetation	None
BK	Lead (3) woodcock	Chromium (27) vegetation Chromium (67) earthworm	None	None

Exhibit 2-17. Summary of Sediment COCs (HQ >1) for ALAAP – Baseline
Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area	Range of Hazard Quotients			
	1 – 9	10 – 99	100 – 999	>1,000
5	None	None	None	None
9	Chromium (4) Lead (3) Manganese (2) Nickel (5) Zinc (2) Benzo(g,h,i)perylene (2) Benzo(k)fluoranthene (2) Chrysene (2) Ideno(1,2,3-cd)pyrene (1)	Arsenic (15) Copper (17)	None	None
16	None	None	None	None
21	Arsenic (3) Chromium (2) Copper (2) Lead (1) Manganese (4) Acetone (5) Pyrene (1)	None	None	None
26	Arsenic (5) Chromium (1) Manganese (2) Acetone (4)	None	None	None
27	Arsenic (2) Chromium (1) Lead (1) Manganese (3) Zinc (2)	None	None	None
CO*	Mercury	None	None	None
TA*	Arsenic (2) Lead (1) Manganese (2)	None	None	None
BK	Arsenic (1) Copper (1) Manganese (2) Acetone (3)	None	None	None

* Coosa River and Talladega Creek are evaluated as part of a separate groundwater investigation for ALAAP – Area B.

Exhibit 2-18. Summary of Surface Water COCs (HQ >1) for ALAAP – Baseline
Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area	Range of Hazard Quotients			
	1 – 9	10 – 99	100 – 999	>1,000
9	Copper (1) aquatic biota Iron (2) aquatic biota Lead (1) aquatic biota	None	None	None
16	None	Cobalt (47) aquatic biota Iron (11) aquatic biota Manganese (10) aquatic biota	None	None
21	Iron (3) aquatic biota Carbon disulfide (1) aquatic biota	Aluminum (15) aquatic biota Barium (14) aquatic biota Manganese (10) aquatic biota	None	None
26	Aluminum (5) aquatic biota Iron (3) aquatic biota	Barium (13) aquatic biota Manganese (10) aquatic biota	None	None
27	Aluminum (3) aquatic biota Iron (2) aquatic biota	Barium (11) aquatic biota Manganese (11) aquatic biota	None	None
CO*	Aluminum (4) aquatic biota	None	None	None
TA*	None	None	None	None
BK	Aluminum (2) aquatic biota Manganese (1) aquatic biota	None	None	None

* Coosa River and Talladega Creek are evaluated as part of a separate groundwater investigation for ALAAP – Area B.

Exhibit 2-19. Chemicals of Concern Following Weight-of-Evidence Assessment Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area		Potential Risk Receptors	Chemicals of Concern	
			Surface Soil	Subsurface Soil
2	Smokeless Powder Facility	Current/ Future Industrial	Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	NA
		Future Residential	Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene Benzo(b)fluoranthene 2,4-Dinitrotoluene
		Future Construction	Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene
3	Sanitary Landfill and Lead Facility	Future Residential	Arsenic	NA
4	Manhattan Project Area	Future Residential	Lead	Lead
7	Northern TNT Manufacturing Area	Future Residential	NA	2,4,6-Trinitrotoluene
8	Acid/Organic Manufacturing Area	Future Residential	Arsenic Nickel Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	Arsenic Antimony Lead
10W	Tetryl Manufacturing Area	Future Residential	Lead	NA
16	Flashing Ground	Future Residential	Arsenic Lead Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	Lead 2,4,6-Trinitrotoluene
		Ecological	Cadmium Copper	NA
17	Propellant Shipping Area	Future Residential	Arsenic	Arsenic
18	Blending Tower Area	Future Residential	Arsenic	NA
19	Lead Facility	Future Residential	NA	Arsenic
21	Red Water Ditch	Future Residential	Arsenic and Aroclor 1254 (fish tissue)	
22	Demolition Landfill	All	Landfill capped	
26	Crossover Ditch	Future Residential	Mercury (fish tissue)	
CERFA Study Area	Building 6 – Coke Oven	Future Residential	NA	Arsenic
EBS Study Area	South Georgia Road Dump Site	Future Residential	Lead	Lead

NA – Not Applicable

2.7.5 Basis for Action

The response actions selected in this ROD are necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

2.8 REMEDIAL ACTION OBJECTIVES AND ASSESSMENT OF ARARs

This section describes the remedial action objectives for the sites in this ROD. In addition, this section discusses the chemical-, location-, and action-specific ARARs for ALAAP – Area B.

2.8.1 Remedial Action Objectives

The remedial action objectives (RAOs) for protecting human receptors will consider both the constituent concentrations and the exposure routes because protectiveness may be achieved by reducing exposure as well as by reducing constituent concentrations. The RAOs also will ensure that the planned remedial alternatives do not affect the local environment significantly because the use of construction equipment can damage sensitive ecosystems. The RAOs for the FS are to:

- Cost effectively reduce the toxicity, mobility, and/or volume of study area chemicals in a timely manner to levels that are protective of human health and the environment
- Minimize exposure risks (i.e., ingestion, inhalation, and dermal pathways) posed to human health and the environment through treatment of contaminated media or by providing an adequate physical barrier between the contaminated media and the receptor
- Restore each study area to a condition that is consistent with future land use requirements.

2.8.2 Applicable or Relevant and Appropriate Requirements

The identification and evaluation of ARARs is an integral part of the FS process in complying with CERCLA and SARA. This section discusses the available Federal and state chemical-, location-, and action-specific ARARs.

Part 121 of CERCLA specifies that remedial actions for cleanup of hazardous substances must comply with requirements or standards under Federal or more stringent state environmental laws that are applicable or relevant and appropriate to the hazardous substances or circumstances at a site. Protection of human health and the environment is addressed by implementing ARARs. In addition, Army Regulations (ARs) 200-1 and 200-2 prescribe Department of the Army (DA) policies, procedures, and responsibilities to protect, preserve, and restore the quality of the environment. ARs 200-1 and 200-2 incorporate all of the applicable statutory and regulatory requirements in various environmental programs.

The selection of ARARs is dependent on the hazardous substances at a site, the physical site characteristics and geographic location, and the actions selected as a remedy, and are addressed by chemical-, location-, and action-specific ARARs, respectively (EPA 1988). The remedial actions developed as part of the FS were analyzed for compliance with Federal and State of Alabama environmental regulations. The remedial action process involves the initial identification of potential requirements and the evaluation of the potential requirements for applicability or relevance and appropriateness.

2.8.2.1 Chemical-specific ARARs

Chemical-specific ARARs are selected to set protective remediation levels for the COCs. These requirements include chemical-specific health- or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants. These requirements generally establish protective cleanup levels for COCs in the designated media or a safe level discharge that may be established when considering a specific remedial activity. Whether potential chemical-specific ARARs are used toward establishing cleanup levels for the site will depend on their applicability to the chosen remedial action alternative. The chemicals identified in soil as COCs at ALAAP – Area B included metals, nitroaromatic explosives, and PAHs. Chemical-specific ARARs that pertain to the preferred remedies are addressed in Section 2.12.4.

2.8.2.2 Location-specific ARARs

Location-specific ARARs set restrictions on the concentrations of hazardous substances or on the conduct of remedial activities based on the physical characteristics of the site or its immediate surroundings. In determining the use of location-specific ARARs for selection of remedial actions at CERCLA sites, the jurisdictional prerequisites of each regulation must be investigated. Basic definitions and exemptions are analyzed on a site-specific basis to confirm the correct applicability of the requirements. Federal and state location-specific ARARs that pertain to these specific physical characteristics for the preferred remedies are addressed in Section 2.12.4.

2.8.2.3 Action-specific ARARs

Action-specific ARARs are technology-based requirements that set controls or restrictions on the design, implementation, and performance levels of remedial activities related to the management of hazardous substances, pollutants, or contaminants. These requirements are triggered by the remedial alternatives selected to clean up the waste and are independent of specific chemicals at a site. Federal and State action-specific ARARs that apply to the preferred alternatives are presented in Section 2.12.4.

2.9 DESCRIPTION OF ALTERNATIVES

The FS (SAIC 2008) identifies and analyzes several possible remedial actions. This section presents a description of the three alternatives considered for Study Areas 3, 4, 16, 17, 18, 19, and the Building 6 – Coke Oven and the six alternatives considered for Study Area 2.

In addition, although remedial alternatives were not developed in the FS for Study Areas 7, 8, 10W, 21, 22, 26, and the South Georgia Road Dump based on the assumption that further action would not be required for the future industrial use at these study areas or because the landfill has been capped (Study Area 22), it has since been determined by the Army, EPA, and ADEM that study areas that do not meet the unrestricted use criteria (including the capped landfill) will require LUCs. To address this requirement, a remedial alternative evaluation was included in the FS for Study Areas, 7, 8, 10W, 21, 22, 26, and the South Georgia Road Dump.

2.9.1 Alternatives for Study Areas 3, 4, 16, 17, 18, 19, and the Building 6 – Coke Oven

Although no COCs were identified for future industrial and construction receptors, LUCs still would be required for these study areas because the COCs would remain in soil at concentrations exceeding the residential RGOs. Therefore, three alternatives satisfying the RAOs were developed for these study areas, including an alternative involving LUCs to prohibit the residential use of the property. An unrestricted use alternative (excavation and offsite disposal) also was developed to comply with DOD policy. The proposed alternatives evaluated include:

- ***Alternative 1 – No Action***—The NCP requires this alternative to be evaluated.
- ***Alternative 2 – Limited Actions***—This alternative involves the use of LUCs, enforceable use restrictions, administrative controls, and inspections. These actions are proposed to protect human receptors from contact with elevated concentrations of COCs in soil. The LUCs would

focus on restricting land use for residential purposes and would become an integral part of the city of Childersburg LRA master plan.

- *Alternative 3 – Excavation and Offsite Disposal*—This unrestricted use alternative involves the excavation of soil containing COCs above the residential RGOs and the offsite disposal of the soil in a secure landfill, such as a RCRA Subtitle D landfill (assuming the soil is nonhazardous). Confirmation samples would be required to characterize the soil prior to disposal, and clean backfill would be necessary to restore the study area. Under this alternative, no long-term effects would occur because the chemicals would be removed.

2.9.2 Alternatives for Study Area 2

Another set of alternatives was developed for Study Area 2 because the baseline risk assessment and weight-of-evidence analysis identified the following COCs for current/future industrial, future construction, and future residential receptors: arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and 2,4-DNT. No COCs were identified for ecological receptors at this study area. The alternatives evaluated for Study Area 2 include:

- *Alternative 1 – No Action*—The NCP requires this alternative to be evaluated.
- *Alternative 2 – Limited Actions*—This alternative involves the use of LUCs, including administrative restrictions, engineering controls, inspections, and maintenance. These measures are proposed to protect human receptors from contact with elevated concentrations of arsenic and PAHs in soil. The LUCs would focus on restricting land use for residential purposes and would become an integral part of the city of Childersburg LRA master plan. In addition, a soil barrier would be installed to prevent human receptors from being exposed to the PAHs in soil.
- *Alternative 3 – In Situ Solidification/Stabilization*—This alternative involves stabilizing and solidifying contaminated soil to reduce the mobility of the chemicals. Topsoil and vegetative cover may be installed on top of the solidified/stabilized surface. Alternatively, the treated surface could be paved. Since waste is being left in place, LUCs would be required with this alternative. Inspections also would be required to monitor the integrity of stabilized soil. Administrative controls would be required to restrict activities that involve excavation at the study area. In addition, a treatability study would be required to determine the appropriate solidification and/or stabilization reagents prior to full-scale implementation. The long-term effectiveness of this alternative will depend on the durability and chemical stability of the treatment reagent. For example, infiltrating rain may locally increase soil or groundwater alkalinity, thereby reducing the stabilization associated with certain chemical species.
- *Alternative 4 – Excavation, High-temperature Thermal Desorption, and Onsite Disposal*—This alternative involves the excavation of soil containing PAHs above the industrial/construction RGOs and treatment through an engineered, onsite remedial action that involves high-temperature thermal desorption (HTTD). Soil preparation would be required prior to treatment and might include screening and/or crushing of coarse solids with separation and subsequent offsite disposal of material too large to treat. The PAH contamination in soil would be removed using a thermal desorption process. Treatment of the off-gas from the process would be required to remove particulates and chemicals. Particulates would be removed using conventional particulate removal equipment. Chemicals would be destroyed in a secondary combustion chamber or a catalytic oxidizer. Upon completion of the thermal desorption process, onsite reuse of the treated soil as backfill may be implemented after pH adjustment and addition of fertilizers. Otherwise, clean backfill would be required to restore

the study area. A treatability study would be required prior to full-scale implementation of this technology. Since COCs would remain in soil at concentrations exceeding the residential RGOs, LUCs would be required to prohibit the residential use of the property.

- *Alternative 5 – Excavation and Offsite Disposal with LUCs*—This alternative involves the excavation of soil containing PAHs above the industrial/construction RGOs and offsite disposal of the soil in a secure landfill, such as a RCRA Subtitle D landfill (assuming the soil is nonhazardous). Confirmation samples would be required to confirm that contaminant concentrations were not present above the RGOs. In addition, samples would be collected to characterize the soil prior to disposal, and clean backfill would be necessary to restore the study area. Since COCs would remain in soil at concentrations exceeding the residential RGOs, LUCs would be required to prohibit the residential use of the property.
- *Alternative 6 – Excavation and Offsite Disposal Without LUCs*—This unrestricted use alternative involves the excavation of soil containing PAH concentrations above the residential RGOs and offsite disposal of the soil in a secure landfill, such as a RCRA Subtitle D landfill (assuming the soil is nonhazardous). Confirmation samples would be required to confirm that contaminant concentrations were not present above the RGOs. In addition, samples would be collected to characterize the soil prior to disposal, and clean backfill would be necessary to restore the study area. Under this alternative, there would be no long-term effects because the chemicals would be removed.

2.9.3 Alternatives for Study Areas 7, 8, 10W, 21, 22, 26, and the South Georgia Road Dump

These study areas were retained for further evaluation because risks remain for the future unrestricted use of the study areas. TNT was identified as the residential COC in soil at Study Area 7. Arsenic, antimony, lead, nickel, and PAHs were identified as residential COCs in soil at Study Area 8. Lead was identified as the residential COC in soil at Study Area 10W and the South Georgia Road Dump. Arsenic and Aroclor 1254 were identified as the residential COCs at Study Area 21 and mercury was identified as the residential COC at Study Area 26 based on consumption of fish tissue. The alternatives evaluated for the study areas include:

- *Alternative 1 – No Action*—The NCP requires this alternative to be evaluated.
- *Alternative 2 – Limited Actions*—This alternative involves the use of LUCs, including administrative restrictions, engineering controls, inspections, and maintenance. These measures are proposed to protect hypothetical residents from contact with residential COCs. The LUCs would focus on restricting residential land use of the study areas and signs to warn against consumption of fish tissue. The LUCs would become an integral part of the city of Childersburg master plan.

2.10 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Nine criteria were used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. The nine criteria include: overall protectiveness of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume of chemicals through treatment; short-term effectiveness; implementability; cost; regulatory agency acceptance; and community acceptance. Regulatory and community acceptance are discussed in Section 3.

2.10.1 *Comparison of Alternatives for Study Areas 3, 4, 16, 17, 18, 19, and the Building 6 – Coke Oven*

COCs were identified and remedial alternatives were identified, screened, and evaluated individually against nine criteria for the protection of future residential receptors at Study Areas 3 (arsenic), 4 (lead), 16 (arsenic, lead, PAHs, and TNT), 17 (arsenic), 18 (arsenic), 19 (lead), and the Building 6 – Coke Oven (arsenic). No COCs were identified for other human receptors and ecological receptors at these study areas, except for ecological risks to cadmium and copper in surface soil at Study Area 16 where the ecological resource conditions do not warrant the development of remedial alternatives to protect these ecological resources. The comparative analysis of remedial alternative to address COCs at Study Areas 3, 4, 16, 17, 18, 19, and the Building 6 – Coke Oven is presented in the following sections. Regulatory and community acceptance are discussed in Section 3.

2.10.1.1 Overall Protection of Human Health and the Environment

The excavation and offsite disposal alternative includes placing the contaminated soil in a regulated disposal facility. This action would provide overall protection of human health and the environment onsite; however, a failure in the offsite landfill containment controls might pose risks to human health and the environment surrounding the landfill.

The limited actions alternative provides adequate protection of human health and the environment by minimizing exposure to the contaminated soil through the use of LUCs at each study area. The LUCs would prohibit future residential use of the study areas.

The no action alternative does not include any actions and, consequently, is not expected to provide protection of human health and the environment against potential exposure to contaminated soil.

2.10.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

The limited actions and offsite disposal alternatives would meet the action- and location-specific ARARs. For the excavation and offsite disposal alternative, a temporary silt fence would be installed around the soil excavation and staging areas to prevent soil erosion and runoff. In addition, dust control measures would be implemented during soil excavation and transportation to comply with air pollution control requirements.

The ARARs are not applicable for the no action alternative because no remedial action would be implemented at the study areas.

2.10.1.3 Long-term Effectiveness and Permanence

The offsite disposal alternative provides long-term effectiveness and permanence at each study area because the contaminated soil would be excavated and removed. At the completion of this alternative, the residual concentrations of COCs in soil would be below residential RGOs. Therefore, no reuse restrictions would be placed on the future use of the study areas and no long-term monitoring (i.e., inspections) of the study areas would be required (i.e., residential reuse is an option). However, the long-term effectiveness and permanence offsite would depend on the containment controls of the offsite landfill facility.

The limited actions alternative will be effective because the LUCs will prohibit residential reuse. However, the effectiveness and permanence in the long term are less certain than the offsite disposal alternative. Although the residential pathway exposure to COCs in soil is eliminated by the limited actions alternative, the magnitude of the risk is not changed in the unlikely event that the LUCs are violated.

The no action alternative does not include any actions and, consequently, does not provide long-term effectiveness and permanence.

2.10.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Although the contaminated soil would be removed from the study areas, there would be no reduction in toxicity, mobility, or volume of chemicals if the soil were disposed of in an offsite landfill without treatment.

The no action and limited actions alternatives would have no effect on the toxicity, mobility, or volume of chemicals because no treatment is involved with these alternatives.

2.10.1.5 Short-term Effectiveness

The no action alternative presents no additional risk to the community, environment, or site workers during its implementation because no actions are associated with this alternative. Since only very minor site disturbance is expected during the implementation of the limited actions alternative, there would be minimal short-term risk to the site workers and the community. Neither of these alternatives would be effective in reducing the chemical concentrations within the study areas.

The offsite disposal alternative poses a moderate risk to the community due to the transportation of contaminated soil on public roads. Proper soil handling techniques would be implemented to prevent or minimize adverse environmental impacts during the implementation of this alternative. All of the alternatives could be implemented in less than 1 year for each study area.

2.10.1.6 Implementability

The no action alternative would be the easiest to implement because it involves no remedial actions. The limited actions would be the next easiest alternative to implement because the services and materials for the actions associated with this alternative are readily available and the implementation could be accomplished with modest effort.

The equipment and services associated with the offsite disposal alternative are available. This alternative has been implemented at other installations and is considered a proven alternative.

2.10.1.7 Cost

The total capital cost, total long-term operation and maintenance (O&M) cost, and total cost for each alternative is presented below. All costs presented in Exhibit 2-20 are based on present worth costs with a 7 percent discount rate. All monitoring and long-term O&M costs were estimated for a 30-year period, which is the conventional approach under similar FSs, although the O&M would be required until threats to human health and the environment from former operations at ALAAP no longer exist.

The excavation and offsite disposal alternative is the most expensive alternative, followed by the limited actions alternative. The offsite disposal alternative requires high capital cost, but no long-term O&M cost. Conversely, the limited actions alternative has low capital cost and higher long-term O&M cost because periodic site inspections and administrative support would be required during the 30-year monitoring period.

Exhibit 2-20. Costs for Study Areas 3, 4, 16, 17, 18, 19, and Building 6 – Coke Oven Alabama Army Ammunition Plant, Childersburg, Alabama

Study Area/Alternative	Capital Cost	Long-term O&M Cost (Present Worth)	Total Cost
Study Area 3:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Alternative 3 – Excavation and Offsite Disposal	$1,428,828	$0	$1,428,828
Study Area 4:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Alternative 3 – Excavation and Offsite Disposal	$733,339	$0	$733,339
Study Area 16:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Alternative 3 – Excavation and Offsite Disposal	$478,485	$0	$478,485
Study Area 17:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Alternative 3 – Excavation and Offsite Disposal	$3,131,687	$0	$3,131,687
Study Area 18:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Alternative 3 – Excavation and Offsite Disposal	$417,226	$0	$417,226
Study Area 19:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Alternative 3 – Excavation and Offsite Disposal	$2,815,132	$0	$2,815,132
Building 6 – Coke Oven:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Alternative 3 – Excavation and Offsite Disposal	$441,460	$0	$441,460

2.10.2 Comparison of Alternatives for Study Area 2

At Study Area 2, COCs were identified for current/future industrial, future construction, and future residential receptors. No COCs were identified for ecological receptors at this study area. Consistent with the anticipated future land use (i.e., industrial and construction), alternatives were developed to address the COCs associated with industrial and construction receptors. One alternative addresses COCs associated with residential use. The comparative analysis of remedial alternative to address the COCs at Study Area 2 is presented below. Regulatory and community acceptance are discussed in Section 3.

2.10.2.1 Overall Protection of Human Health and the Environment

The offsite disposal alternative without LUCs provides the best overall protection of human health and the environment. This alternative would result in the unrestricted use of the study area by removing the COCs exceeding both industrial/construction and residential RGOs. The contaminated soil would be removed from the study area and disposed of in a regulated landfill facility. Although this action would provide overall protection of human health and the environment onsite, a failure in the offsite landfill containment controls might pose risks to human health and the environment surrounding the landfill. The other alternatives require LUCs to restrict residential use.

The HTTD alternative (Alternative 4) provides good overall protection of human health and the environment. This alternative removes the chemicals exceeding the industrial/construction RGOs in an irreversible process, therefore providing long-term protection at the study area. In addition, LUCs would be implemented to prohibit the residential use of the property.

The offsite disposal alternative with LUCs provides good overall protection of human health and the environment. This alternative would remove the soil containing COCs exceeding the industrial/construction RGOs from the study area. In addition, LUCs would be implemented to prohibit the residential use of the property. The contaminated soil removed from the study area would be disposed of in an offsite regulated landfill facility. Although this action would provide overall protection of human health and the environment onsite, a failure in the offsite landfill containment controls might pose risks to human health and the environment surrounding the landfill.

The in situ solidification/stabilization (S/S) alternative also provides good overall protection of human health and the environment by eliminating the pathways to the chemicals. However, the chemicals remain in soil at the study area. The limited actions alternative provides adequate protection of human health and the environment by minimizing exposure to the contaminated soil through the use of engineering (protective soil barrier) and administrative controls. The engineering controls would protect the industrial/construction receptors from being exposed to the contaminated soil while the administrative controls would prohibit future residential use of the study area.

The no action alternative does not include any actions and, consequently, is not expected to provide protection of human health and the environment against potential exposure to contaminated soil.

2.10.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

All of the alternatives would meet the action- and location-specific ARARs. Appropriate air pollution control measures would be implemented for the HTTD unit and offsite disposal alternatives to comply with the air pollution control requirements. In addition, a temporary silt fence would be installed around the soil excavation and staging areas to prevent soil erosion and runoff.

The requirements are not applicable for the no action alternative because no remedial action would be implemented at the study area.

2.10.2.3 Long-term Effectiveness and Permanence

The offsite disposal alternative without LUCs provides the best long-term effectiveness and permanence at the study area because the contaminated soil would be excavated and removed. At the completion of this alternative, the residual concentrations of COCs in soil at Study Area 2 would be below the industrial/construction and residential RGOs. No restrictions would be placed on the future use of the study area and no long-term monitoring (i.e., inspections) of the study area would be required. However, the long-term effectiveness and permanence offsite would depend on the containment controls of the offsite landfill facility.

The HTTD alternative provides good long-term effectiveness and permanence. This alternative removes PAHs from the soil in an irreversible treatment process. After treatment, the soil within the study area would contain concentrations of COCs below industrial and construction RGOs. Since COCs would remain in soil at concentrations exceeding the residential RGOs, LUCs would be implemented to prohibit residential use of the property.

The offsite disposal alternative with LUCs provides good long-term effectiveness and permanence at Study Area 2 because the COCs exceeding the industrial/construction RGOs would be removed. However, the long-term effectiveness and permanence offsite would depend on the containment controls of the offsite landfill facility. Since COCs would remain in soil at concentrations exceeding the residential RGOs, LUCs would be implemented to prohibit residential use of the property.

The in situ S/S alternative is less effective than the offsite disposal and HTTD alternatives. This alternative would eliminate the pathways to contamination, but the chemicals would remain within the study area. The limited actions alternative will be effective because the LUCs will prohibit residential reuse. However, the effectiveness and permanence in the long term are less certain than the offsite disposal alternative. Although the residential pathway exposure to COCs in soil is eliminated by the limited actions alternative, the magnitude of the risk is not changed in the unlikely event that the LUCs are violated.

The no action alternative does not include any actions and, consequently, does not provide long-term effectiveness and permanence.

2.10.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The HTTD alternative reduces the toxicity, mobility, and volume of chemicals by treating and removing the PAHs from the soil to below industrial/construction RGOs. In situ S/S would reduce the mobility of the chemicals, but it does not reduce the toxicity or volume.

For the offsite disposal alternative(s), the contaminated soil would be removed from Study Area 2. However, there would be no reduction in toxicity, mobility, or volume of chemicals if the soil was disposed of in an offsite landfill without treatment.

The no action and limited actions alternatives would have no effect on the toxicity, mobility, or volume of chemicals because no treatment is involved with these alternatives.

2.10.2.5 Short-term Effectiveness

The no action alternative presents no additional risk to the community, environment, or site workers during its implementation because no actions are associated with this alternative. Since only minor site disturbance is expected during the implementation of the limited actions alternative, there would be minimal short-term risk to the site workers, the environment, and the community. Neither of these alternatives would be effective in reducing the chemical concentrations within the study area.

The in situ S/S alternative is not expected to create significant risk to the environment or community. Site worker risks would be mitigated through the implementation of a proper health and safety plan (HASP).

The HTTD alternative would create risks to the site workers during the handling of contaminated soil during the treatment process. Site worker risks would be mitigated through the implementation of a proper HASP. In addition, this alternative potentially may pose risks to the community due to air emissions from the treatment process.

The offsite disposal alternatives pose a modest risk to the community due to the transportation of contaminated soil on public roads. Proper soil handling techniques would be implemented to prevent or minimize adverse environmental impacts during the implementation of this alternative.

All of the alternatives (excluding long-term monitoring) could be implemented in less than 1 year. The in situ S/S and HTTD alternatives might require additional time beyond 1 year to conduct treatability testing and develop the remedial design.

2.10.2.6 Implementability

The no action alternative would be the easiest to implement because it involves no remedial actions. The limited actions would be the next easiest alternative to implement because the equipment and services for the actions associated with this alternative are readily available and the implementation could be accomplished with modest effort.

The equipment and services associated with the in situ S/S, HTTD, and offsite disposal alternatives are available. Offsite disposal has been implemented at other installations and is considered a proven alternative. The in situ S/S and HTTD alternatives each would require a treatability study prior to full-scale implementation.

2.10.2.7 Cost

The total capital cost, total long-term O&M cost, and total cost for each alternative are presented below. All costs presented in this table are based on present worth costs with a 7 percent discount rate. All monitoring and long-term O&M costs were estimated for a 30-year period, which is the conventional approach under similar FSs although the O&M would be required until threats to human health and the environment from former operations at ALAAP no longer exist. Exhibit 2-21 presents the costs associated with each alternative for Study Area 2.

Exhibit 2-21. Costs for Study Area 2
Alabama Army Ammunition Plant, Childersburg, Alabama

Cost	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
	No Action	Limited Actions	In Situ S/S	Excavation, HTTD, and Onsite Disposal	Excavation and Offsite Disposal with LUCs	Excavation and Offsite Disposal without LUCs
Capital Cost	$0	$91,038	$282,593	$601,566	$128,119	$2,272,907
Long-term O&M Cost	$0	$65,714	$63,505	$63,505	$63,505	$0
Total Cost	$0	$155,752	$346,098	$665,071	$191,624	$2,272,907

The excavation and offsite disposal alternative without LUCs is the most expensive alternative, followed by the HTTD alternative and then the in situ S/S alternative. The limited actions alternative is the least expensive alternative requiring action. The offsite disposal alternative without LUCs requires capital cost, but no long-term O&M costs. All of the remaining alternatives requiring action would include both capital and long-term O&M costs.

2.10.3 Comparison of Alternatives for Study Areas 7, 8, 10W, 21, 22, 26, and the South Georgia Road Dump

The comparative analysis of remedial alternative to address the COCs at Study Areas 7, 8, 10W, 21, 22, 26, and the South Georgia Road Dump is presented in the following sections. Regulatory and community acceptance are discussed in Section 3.

2.10.3.1 Overall Protection of Human Health and the Environment

The limited actions alternative provides adequate protection of human health and the environment by minimizing exposure to the COCs through the use of LUCs at each study area. The LUCs would prohibit future residential use of the study areas.

The no action alternative does not include any actions and, consequently, is not expected to provide protection of human health and the environment against potential exposure to contaminated soil.

2.10.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

The limited actions alternative would meet the action- and location-specific ARARs. The ARARs are not applicable for the no action alternative because no remedial action would be implemented at the study areas.

2.10.3.3 Long-term Effectiveness and Permanence

The limited actions alternative would be effective because the LUCs would restrict residential reuse. Under the limited actions alternative, the magnitude of the residential risk does not change because the COCs remain in place.

The no action alternative does not include any actions and, consequently, does not provide long-term effectiveness and permanence.

2.10.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The no action and limited actions alternatives would have no effect on the toxicity, mobility, or volume of chemicals because no treatment is involved with these alternatives.

2.10.3.5 Short-term Effectiveness

The no action alternative presents no additional risk to the community, environment, or site workers during its implementation because no actions are associated with this alternative. Since only very minor site disturbance is expected during the implementation of the limited actions alternative, there would be minimal short-term risk to the site workers and the community. Neither of these alternatives would be effective in reducing the chemical concentrations within the study areas. The remedial alternatives could be implemented in less than 1 year for each study area.

2.10.3.6 Implementability

The no action alternative would be the easiest to implement because it involves no remedial actions. The limited actions also would be easy to implement because the services and materials for the actions associated with this alternative are readily available and the implementation could be accomplished with modest effort.

2.10.3.7 Cost

The total capital cost, total long-term O&M cost, and total cost for each alternative are presented below. All costs presented in Exhibit 2-22 are based on present worth costs with a 7 percent discount rate. All monitoring and long-term O&M costs were estimated for a 30-year period, which is the conventional approach under similar FSs, although the O&M would be required until threats to human health and the environment from former operations at ALAAP no longer exist.

2.11 PRINCIPAL THREAT WASTES

Principal threat wastes are defined as source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur (EPA 1999). Generally, principal threat wastes have toxicity and mobility characteristics that pose a potential risk of 10^{-3} or greater (EPA 1991c). The ALAAP – Area B study areas do not contain source materials that pose risks of 10^{-3} or greater for future industrial land use (most likely land use) or for future residential use (which uses the most conservative risk assumptions). Therefore, principal threat wastes are not an issue of concern at the ALAAP – Area B site.

Exhibit 2-22. Summary of Costs for the Remedial Alternatives for Study Areas 7, 8, 10W, 21, 22, 26, and the South Georgia Road Dump

Study Area/Alternative	Capital Cost	Long-term O&M Cost (Present Worth)	Total Cost
Study Area 7:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Study Area 8:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Study Area 10W:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Study Area 21:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
Study Area 22:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$120,091	$146,966
Study Area 26:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380
South Georgia Road Dump:			
Alternative 1 – No Action	$0	$0	$0
Alternative 2 – Limited Actions	$26,875	$63,505	$90,380

Note: O&M present worth costs were based on a 7 percent investment rate for a 30-year period.

2.12 SELECTED REMEDY

This section describes remedial actions that have been implemented at portions of ALAAP – Area B and recorded in IRODs, and the rationale, cost, and cleanup goals for the Selected Remedies for Study Areas 2, 3, 4, 16, 17, 18, 19, and the Building 6 – Coke Oven.

2.12.1 IROD for Study Areas 31, 32, TC4A, and TC4B (Stockpiled Soils)

An IROD was issued in December 1991 for Study Areas 31, 32, TC4A, and TC4B (Stockpiled Soils) (U.S. Army 1991). The Selected Remedy for the study areas discussed in the IROD included thermal treatment of soils contaminated with metals, explosives, and asbestos and onsite disposal of the soils. The remedial actions outlined in the IROD were initiated on April 9, 1994 and completed on August 22, 1994. In addition, the buildings associated with the Stockpiled Soils were dismantled and the slab was decontaminated.

2.12.2 IROD for Study Areas 6, 7, 10, and 21

An IROD was issued for Study Areas 6, 7, 10, and 21 on November 14, 1994 (Weston 1994). The Selected Remedy for the study areas discussed in the IROD included the incineration/stabilization of metals- and explosives-contaminated soils and sediments associated with the former manufacturing and waste disposal areas and deactivation and grouting of concrete-encased VCP and excavation, incineration, and onsite disposal of VCP associated with the former Industrial Sewer System. The remedial actions outlined in the IROD were initiated in January 1995 and completed in June 1996. The incinerator was removed and the site restored by April 24, 1998.

2.12.3 IROD for Study Areas 2, 10, 16, 17, 19, and 22

An IROD was issued for Study Areas 2, 10, 16, 17, 19, and 22 in October 1996 (Weston 1996e). The Selected Remedy for the study areas discussed in the IROD included the incineration/stabilization of metals- and explosives-contaminated soils for Study Areas 2, 10, 16, 17, and 19 and design and construction of an engineered cap at Study Area 22. The remedial actions outlined in the IROD for Study Areas 2, 10, 16, 17, and 19 were initiated in November 1996 and completed on January 18, 1997. The remedial actions outlined in the IROD for Study Area 22 were initiated in October 1998; the final topographic survey after placing the protective fill over the geomembrane was completed on February 23, 1999.

Upon completion of the IRODs, subsequent sampling indicated that further actions were necessary for some of the sites included in the IRODs (i.e., Study Areas 2, 16, 17, and 19). These study areas are included in the Selected Remedies outlined in this ROD.

2.12.4 Selected Remedies

The Selected Remedies were selected over other alternatives because they are expected to achieve substantial and long-term risk reduction and are expected to allow the property to be used for the reasonably anticipated future land use, which is industrial. Hence, the Limited Action Alternative (Alternative 2) for Study Areas 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 22, 26, the Building 6 – Coke Oven, and the South Georgia Road Dump and the Excavation and Offsite Disposal with LUCs Alternative (Alternative 5) for Study Area 2, hereafter referred to as the Selected Remedies, will meet the RAOs, as follows:

- Although the Selected Remedies do not reduce the toxicity, mobility, or volume of COCs, the Selected Remedies are cost effective, timely, and protective of human health and the environment based on the reasonably anticipated future land use.
- The Limited Action Alternative (Alternative 2) reduces exposure and the Excavation and Offsite Disposal with LUCs Alternative (Alternative 5) minimizes exposure risk (i.e., ingestion, inhalation, and dermal pathways) posed to human health and the environment by providing an adequate physical barrier (i.e., landfill cap) between the contaminated media and the receptor.
- The Limited Action Alternative (Alternative 2) is consistent with future land use requirements and the Excavation and Offsite Disposal with LUCs Alternative (Alternative 5) will restore Study Area 2 to a condition that is consistent with future land use requirements.

Based on the information available at this time, EPA and the State of Alabama believe the Selected Remedies would be protective of human health and the environment, would comply with ARARs, and would be cost effective. The chemical-, location-, and action-specific ARARs for the Selected Remedies are presented in Exhibit 2-23. Because the Selected Remedies would not treat the source materials constituting principal threats, the remedy would not meet the statutory preference for the selection of a remedy that involves treatment as a principal element. The Army recognizes the statutory preference against offsite land treatment of wastes (e.g., Alternative 5 for Study Area 2). However, the volume of soil requiring offsite treatment is low and Alternative 5 provides easier implementability at a significantly lower cost than onsite treatment alternatives.

The estimated total cost per site for the Selected Remedy (Alternative 2 – Limited Action Alternative) at Study Areas 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 26, the Building 6 – Coke Oven, and the South Georgia Road Dump is $90,380. Alternative 2 would incur a capital cost (per site) of $26,875 and a long-term O&M cost of $63,505. The estimated total cost for the Selected Remedy at Study Area 22 is $146,966. Alternative 2 would incur a capital cost of $26,875 and a long-term O&M cost of $120,091.

Exhibit 2-23. Applicable or Relevant and Appropriate Requirements
Alabama Army Ammunition Plant, Childersburg, Alabama

Standard Requirement Criteria or Limitation	Citation	Description	Prerequisites
Archaeological and Historical Preservation Act	43 CFR 7.4	Establishes procedures to provide preservation of historical and archaeological data that might be destroyed through alteration of terrain as a result of a Federal construction project or a federally licensed activity or program.	Excavation, removal, damage, or alteration of any subsurface archaeological resources. Relevant and appropriate to Alternative 5.
Alabama Graveyard Protection Regulations	Code of Alabama, Section 13A-7-23.1	Establishes procedures to prevent desecration or defacement of memorials or damage to corpses.	Excavation, removal, damage, or alteration of any subsurface monuments or corpses. Relevant and appropriate to Alternative 5.
Alabama Water Quality Criteria (AWQC)	Alabama Administrative Code, Chapter 335-6-10	Establishes anti-degradation policy based on water use classifications and potentially impacted wildlife, fish, and aquatic life. Based on 60 mg $CaCO_3$/L hardness.	Erosion of surface soils or releases of contaminated soils into waterways. Turbidity from soil runoff must not exceed 50 NTUs. Relevant and appropriate to both Alternatives 2 and 5.
Alabama Air Pollution Control Rules and Regulations	Alabama Administrative Code, Chapter 335-3-4-.02	Sets emission standards and establishes permitting requirements for air pollutants.	Generation of fugitive dust during excavation and soil transportation without taking "reasonable precautions" to limit emissions (e.g., spraying water). Relevant and appropriate to Alternative 5.
Alabama Hazardous Waste Regulations	Alabama Administrative Code, Chapter 335-14-5-.19(3)(a) and 335-14-5-.19(3)(f) and (g)	Establishes standards that define the acceptable management of hazardous waste and provides special provisions for cleanup.	Describes the requirements for implementing remedies, corrective actions, or cleanup at a facility and for storage and/or treatment in which wastes will not remain after closure. Relevant and appropriate to Alternative 5.
Alabama Hazardous Waste Regulations	Alabama Administrative Code, Chapter 335-14-5.19(5)(d)(1) and (d)(2)(i-vi)	Establishes standards that define the acceptable management of hazardous waste and provides special provisions for cleanup.	Describes standards and design criteria for a temporary remediation staging pile. Relevant and appropriate to Alternative 5.
Alabama Hazardous Waste Regulations	Alabama Administrative Code, Chapter 335-14-5-.19(5)(e)	Establishes standards that define the acceptable management of hazardous waste and provides special provisions for cleanup.	Establishes requirements for ignitable or reactive waste in a staging pile. Relevant and appropriate to Alternative 5.

Exhibit 2-23. Applicable or Relevant and Appropriate Requirements
Alabama Army Ammunition Plant, Childersburg, Alabama (Continued)

Standard Requirement Criteria or Limitation	Citation	Description	Prerequisites
Alabama Hazardous Waste Regulations	Alabama Administrative Code, Chapter 335-14-5-.19(5)(f)	Establishes standards that define the acceptable management of hazardous waste and provides special provisions for cleanup.	Establishes requirements for incompatible remediation waste in a staging pile. Relevant and appropriate to Alternative 5.
Alabama Hazardous Waste Regulations	Alabama Administrative Code, Chapter 335-14-5-.19(5)(j)(1)	Establishes standards that define the acceptable management of hazardous waste and provides special provisions for cleanup.	Establishes requirements to close a temporary remediation waste pile within 180 days after the operating term expires. Relevant and appropriate to Alternative 5.

Alternative 2 – Land Use Controls (Preferred Alternative for Study Areas 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 22, 26, Building 6 – Coke Oven, and South Georgia Road Dump)
Alternative 5 – Excavation and Offsite Disposal with Land Use Controls (Preferred Alternative for Study Area 2)

Although Alternative 2 – Limited Action Alternative was also the Selected Remedy for Study Area 22, the estimated total cost is elevated due to additional requirements associated with the long-term monitoring and maintenance of the landfill.

The estimated total cost for the Selected Remedy at Study Area 2 (Alternative 5 – Excavation and Offsite Disposal with LUCs) is $191,624. Alternative 5 would incur a capital cost of $128,119 and a long-term O&M cost of $63,505.

The cleanup level for the COCs are identified in the Exhibit 2-24.

Exhibit 2-24. COC Cleanup Levels
Alabama Army Ammunition Plant, Childersburg, Alabama

Chemical of Concern	Concentration in Soil (mg of chemical/kg of soil)		
	Human Health RGO (Residential)	Human Health RGO (Industrial/Construction)	Ecological RGO
Arsenic*	20	270	—
Cadmium	—	—	5
Copper	—	—	127
Lead	400	1,200	—
2,4-Dinitrotoluene	9.1	—	—
2,4,6-Trinitrotoluene	37	—	—
Benzo(a)anthracene	8	55	—
Benzo(a)pyrene	0.8	5.5	—
Benzo(b)fluoranthene	8	55	—
Benzo(k)fluoranthene	80	548	—
Dibenzo(a,h)anthracene	0.8	5.5	—
Indeno(1,2,3-cd)pyrene	8	55	—

*Arsenic cleanup levels or RGOs in soil are based on soil policy of EPA Region 4 Office of Technical Services (Simon 2002)

Since LUCs are required for each of the study areas where a remedy has been selected, the performance objectives for the LUCs are outlined below:

- Prohibit the development and use of the property for residential purposes to include residential housing, elementary and secondary schools, and child care facilities
- Prohibit excavation, digging, drilling, or other activities that may damage the landfill cap within Study Area 22 (Demolition Landfill)
- Monitor the effectiveness of the LUCs and monitor for any damage to the landfill cap through annual inspection at Study Area 22 (Demolition Landfill).

The study areas where LUCs will be implemented are shown in Exhibit 2-25. However, the entire ALAAP – Area B property line is the LUC boundary line. The performance objectives will be met by implementing LUCs that include the following:

Property Restrict = Deed = LUC

- Deed restrictions that clearly prohibit any future residential use of the property
- Deed restrictions that clearly prohibit excavation, digging, drilling, or other activities that may damage the landfill cap within Study Area 22
- Periodic inspection and reporting of the condition of the landfill cap and maintenance of the cap.

These LUCs will be maintained throughout the future in perpetuity until the concentration of hazardous substances in the soils and groundwater are at such levels to allow for unrestricted use and exposure. The Army is responsible for implementing, maintaining, reporting on, and enforcing the LUCs.

Although the Army has transferred the procedural responsibilities to the city of Childersburg by property transfer agreement, the Army shall retain ultimate responsibility for remedy integrity.

A LUC remedial design will be prepared as the land use component of the remedial design. Within 90 days of signature of this ROD, the Army shall prepare and submit to EPA and ADEM for review and approval a LUC remedial design that shall contain implementation and maintenance actions, including periodic inspections. The document also will specify the LUC duration, requirements for changes, and maintenance and reporting responsibilities as follows:

- ***LUC Duration***—The LUCs will be maintained until the concentrations of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure.
- ***LUC Maintenance and Reporting***—The Army will be responsible for implementing, maintaining, reporting on, and enforcing the LUCs described in this ROD in accordance with the LUC remedial design document.

Not Required

As specified in the Alabama Uniform Environmental Covenant Act (UECA), Code of Alabama §§ 35-19-1 to 35-19-14 and in the ADEM Uniform Environmental Covenant Program regulations, AAC 335-5, ADEM has requested and the city of Childersburg has agreed to enter into an Environmental Covenant as specified in 335-5-1.07(2). The Army will coordinate with the city of Childersburg as necessary during the development of the LUC remedial design (RD) implementation document, which will describe short- and long-term implementation actions for the site LUCs (DOD 2003). Actions necessary to implement the requirements of the Environmental Covenant will be specified in the LUC RD. The Army may be designated as a "holder" as defined by AAC 335-5-1.03(h), but will not undertake any obligations, including but not limited to any obligation to record or to require the city of Childersburg to record the Environmental Covenant. The Army's rights under the environmental covenant shall be no more extensive than those in the deed transferring the property to the city of Childersburg.

Good Point

language + Recording

not in line w/ UECA!

Acceptable / Great improvement w/ ADEM UECA not ARAR IC

2.13 STATUTORY DETERMINATIONS

Under CERCLA and the NCP, remedies must be selected that are protective of human health and the environment, comply with ARARs, are cost effective, and use permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against offsite disposal of untreated wastes. The following sections discuss how the Selected Remedies meet these statutory requirements.

2.13.1 Protection of Human Health and the Environment

The Limited Actions alternative for Study Areas 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 22, 26, the Building 6 – Coke Oven, and the South Georgia Road Dump (Alternative 2) would be protective of human health by restricting residential use of the study area, therefore meeting RGOs for planned industrial use. No significant environmental improvement is expected after implementing this alternative.

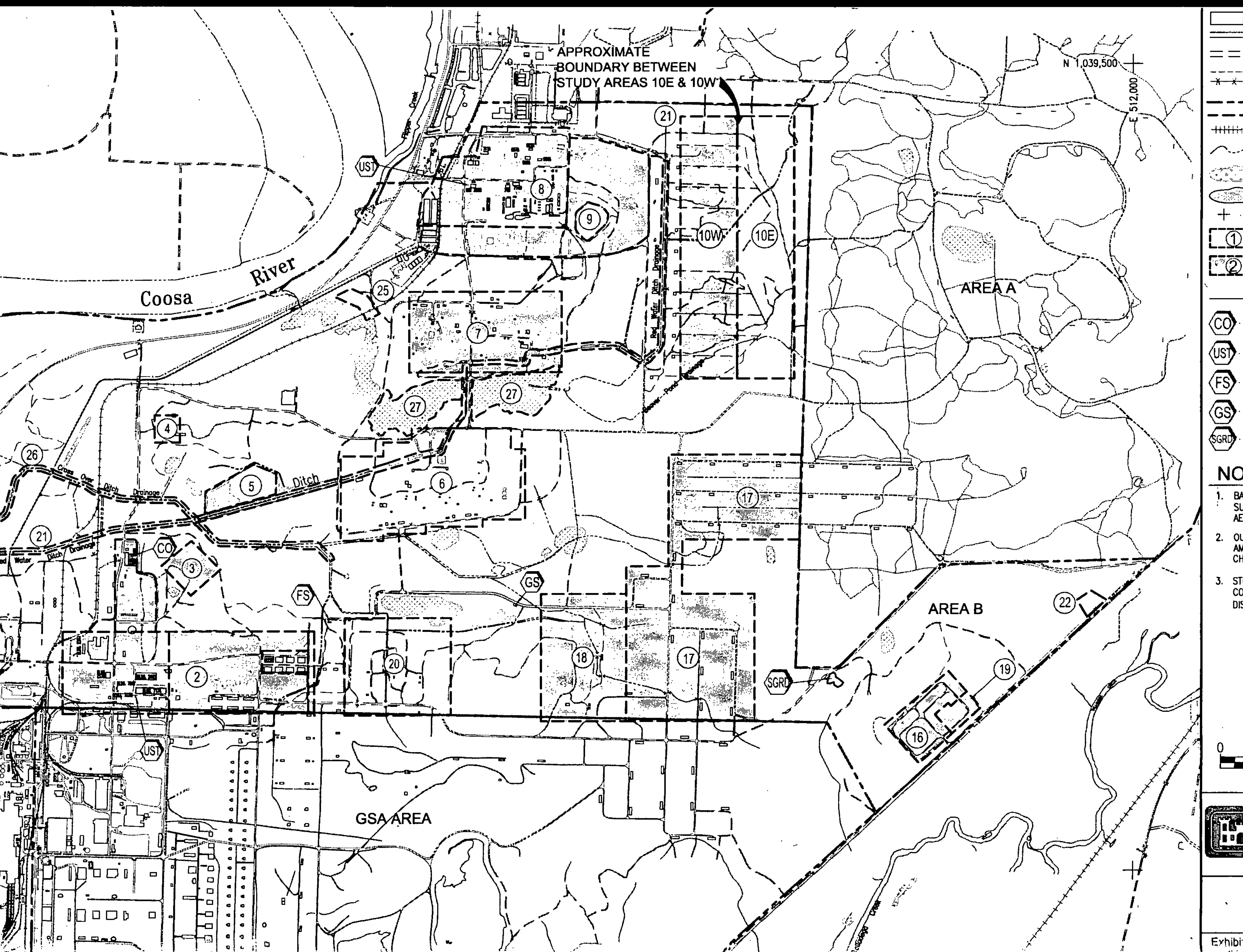
The Excavation and Offsite Disposal with LUCs for Study Area 2 (Alternative 5) would provide adequate protection of human health and the environment through the removal of soil contaminated with PAHs above the industrial/construction RGOs. Following the implementation of this alternative, the human health risks associated with industrial/construction receptors would be removed from Study Area 2. In addition, LUCs would be implemented to restrict access and residential use of the study area, thereby meeting RGOs for planned industrial use. Because PAH-contaminated soil would be landfilled offsite, a limited liability for future impacts to human health and the environment exists in the event of a failure in the landfill containment controls.

Unique site other than

Looked @ it + discussed w/ Daniel. This language has not committed EPA - All future docs LUCRD. Army reserved right not to do it. Good step to wait UECA done

Requirements - not ARARs. Draft Cov SSN, Record

mostly not to link



APPROXIMATE BOUNDARY BETWEEN STUDY AREAS 10E & 10W
N 1,039,500
E 512,000
Coosa River
Red Water Ditch Drainage
Cross Over Ditch Drainage
AREA A
AREA B
GSA AREA
UST
CO
FS
GS
SGRD
10W
10E
NO
Exhibit

2.13.2 Compliance with ARARs

No chemical-specific requirements are available for soil remediation. The limited action alternative for Study Areas 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 22, 26, the Building 6 – Coke Oven, and the South Georgia Road Dump (Alternative 2) would comply with action- and location-specific requirements, which are listed in Exhibit 2-23.

The Excavation and Offsite Disposal with LUCs for Study Area 2 (Alternative 5) would comply with action- and location-specific requirements, which are provided in Exhibit 2-23. Dust control measures would be implemented during the excavation, loading, and hauling of soil to minimize potential impacts from fugitive dust emissions. In addition, a temporary silt fence would be installed around the soil excavation and staging areas to prevent soil erosion and runoff. Soil would be transported to a RCRA Subtitle D landfill for disposal (assuming soil is nonhazardous).

2.13.3 Cost Effectiveness

In the Army's judgment, the Selected Remedies are cost effective and represent a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost effective if its costs are proportional to its overall effectiveness." This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness then was compared to costs to determine cost effectiveness. The relationship of the overall effectiveness of the remedial alternatives was determined to be proportional to its costs; hence, the Selected Remedies represent a reasonable value for the money spent.

2.13.4 Utilization of Permanent Solutions

The Army has determined that the Selected Remedies represent the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the Selected Remedies provide the best balance of trade-offs in terms of the five balancing criteria while also considering the statutory preference for treatment as a principal element, the bias against offsite treatment and disposal, and state and community acceptance.

The limited actions remedy selected for Study Areas 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 22, 26, the Building 6 – Coke Oven, and the South Georgia Road Dump (Alternative 2) does not utilize a permanent solution; however, it is cost effective, timely, and protective of human health and the environment, and is consistent with future land use requirements (industrial land use).

While the Army recognizes the statutory preference against offsite land treatment of wastes, the volume of soil requiring offsite treatment for Alternative 5 at Study Area 2 is low (181 cubic yards) and provides easier implementability at a significantly lower cost than onsite treatment alternatives.

2.13.5 Preference of Treatment as a Principal Element

Because the Selected Remedies would not treat the source materials constituting principal threats, the remedies would not meet the statutory preference for the selection of a remedy that involves treatment as a principal element. However, the Selected Remedies were selected over other alternatives because they are expected to achieve substantial and long-term risk reduction and are expected to allow the property to be used for the reasonably anticipated future land use, which is industrial.

2.13.6 *Five-Year Review Requirements*

Because these remedies will result in contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the ALAAP – Area B site was released for public comment in September 2008. The Proposed Plan identified Alternative 5 for Study Area 2, excavation and offsite disposal with LUCs, and Alternative 2 for Study Areas 3, 4, 7, 8, 10W, 16, 17, 18, 19, 21, 22, 26, the Building 6 – Coke Oven, and the South Georgia Road Dump, which employs limited actions, as the Selected Remedies for remediation. A public meeting was held at the Childersburg City Hall on September 23, 2008. EPA and ADEM were present at the public meeting, and answered questions received from the public. There were no written comments received during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

3. RESPONSIVENESS SUMMARY

This section provides the responsiveness summary that addresses stakeholder participation in the remedy selection process for the study areas evaluated at ALAAP – Area B. This includes public involvement and acceptance of the materials presented in the Proposed Plan and this ROD and regulatory agency approval of the Selected Remedies.

3.1 PUBLIC MEETING AND PERCEPTIONS FROM COMMENT PERIOD

The public reaction to the Selected Remedies is acceptance of the remedy. The notice of availability of the Proposed Plan was published on September 17 and 21, 2008 in the local Childersburg newspaper, and a public comment period was held from September 17 to October 16, 2008. A public meeting was held on September 23, 2008 in Childersburg, Alabama at the Childersburg City Hall. The public was given the opportunity to comment and ask questions about the Selected Remedies. Several questions were asked, but no concerns were received from the public. No comments were received during the public comment period. The public appears to have no substantive concerns regarding implementation of the Selected Remedy.

The following is a summary of the questions raised by the public and Army/regulator/contractor responses given at the meeting.

Question 1: How many acres would be involved in Area 2 that is going to be excavated?

Answer at meeting (USACE): In Area 2 itself?

Answer at meeting (U.S. Army): It's an area of 160 feet by 120 feet.

Question 2: Would there be an actual change in the phrasing in the deeds for the land based on this proposed action?

Answer at meeting (ADEM): There would not.

Answer at meeting (U.S. Army): The deed was restricted at the time it was sold. This final ROD documents the final decision for all of the Area B soil, so it includes what has happened in the past with the interim RODs. This Proposed Plan is to provide land use controls throughout the property for areas that are not safe for residential use and for the Area 2 excavation.

So the deed would not change. The deed was restricted at the time of transfer based on the environmental condition. This is just the final environmental solution that documents the level of cleanup per each designated site.

Answer at meeting continued (Contractor): If you look at the deed, Katherine, it actually does say the property can be used for commercial industrial purposes. It can't ever be used for residential purposes. I don't believe the intent is for that wording to ever change as a result of this or any future property transfer.

3.2 REGULATORY AGENCY ACCEPTANCE

The Proposed Plan was reviewed and approved by EPA and ADEM. Comments were received from EPA and ADEM on the ROD; the comments were addressed and incorporated into this Final ROD.

4. REFERENCES

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Concern on UECA language

· we regard to implement

- Special
  - Fair enough to view not ARAR.

- What Does this language actually say.

Redstone ROD
  purely WRD support
  LUCs